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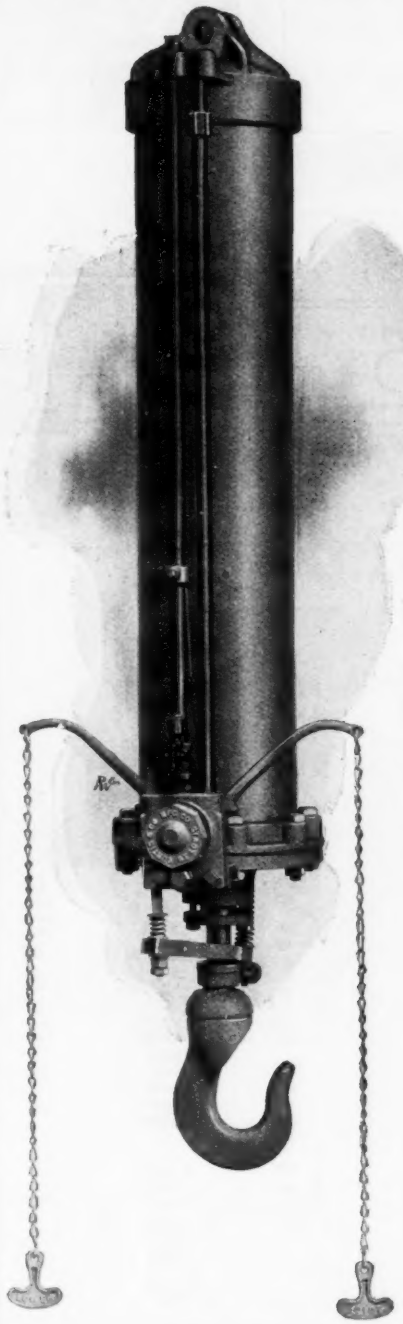

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"Please Turn the Crank

Again and let us have copy," yells the sassy Editor of *The Foundry.*

As we get this space by the year we have to do what the Editor says, but really just now what is worrying us is not how to get new business, but how are we going to get all the elevators made that will be required of us this year.

The whole world of shop managers is waking up to the fact that the Ridgway Steam-Hydraulic is the greatest buy in the market when an elevator is required.

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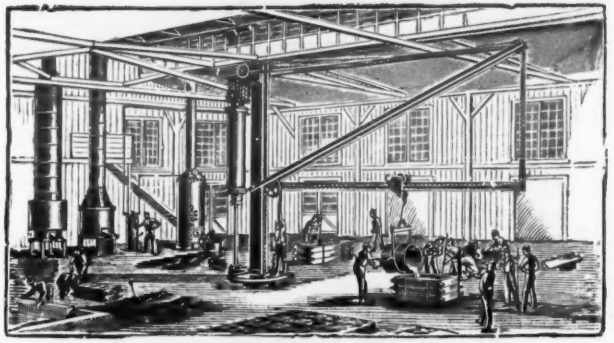

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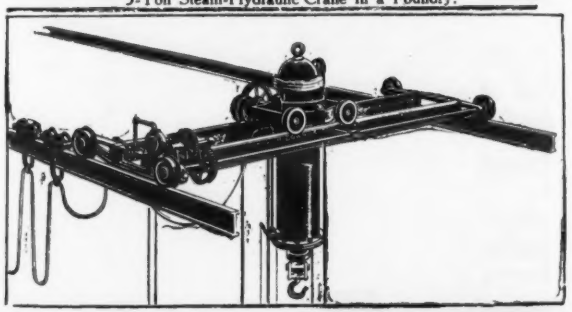

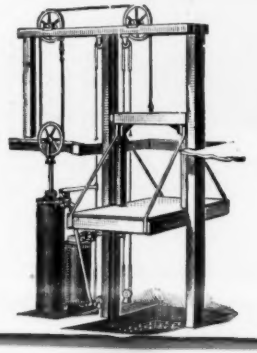

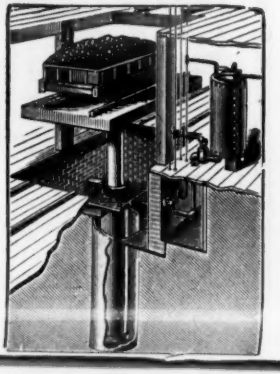

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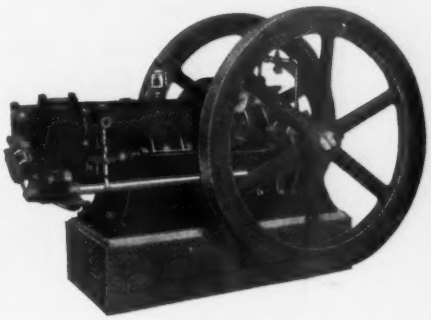

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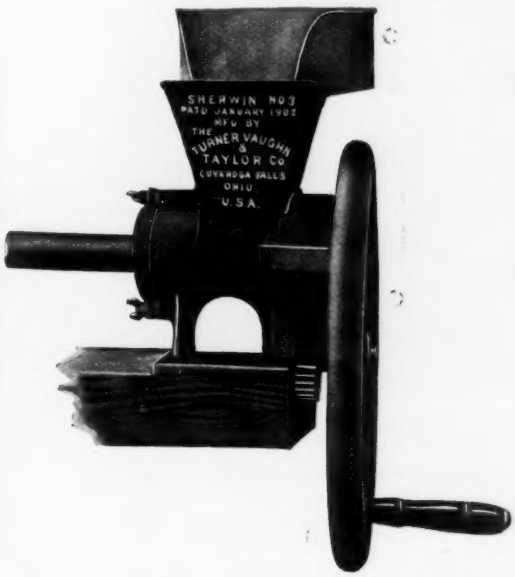

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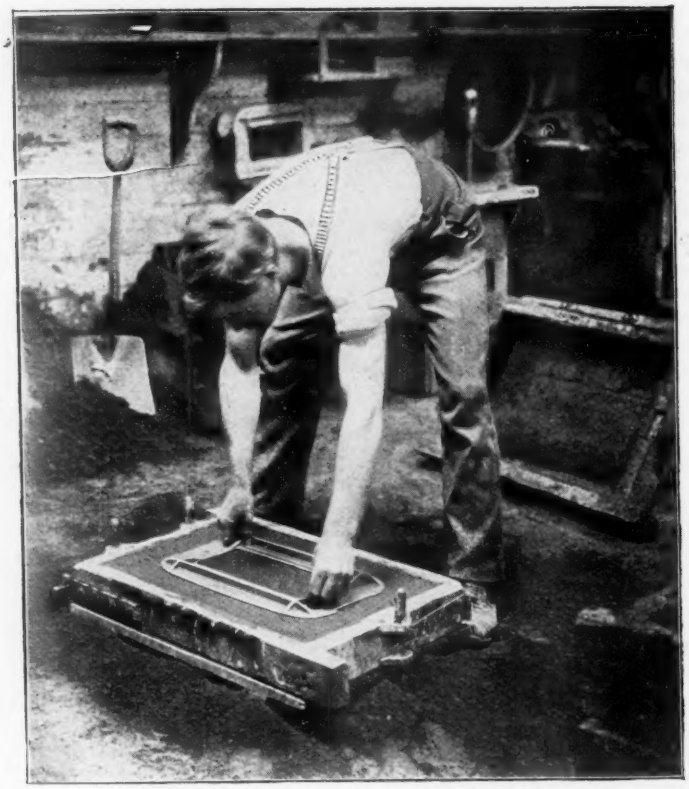

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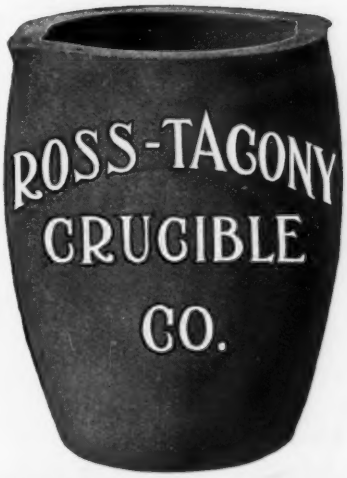

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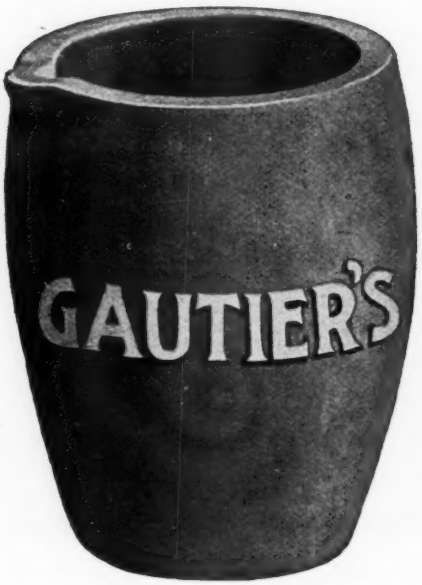

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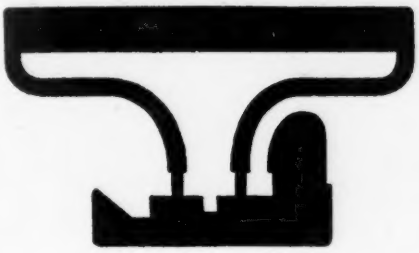

No Rough Castings because when the metal is poured around a Holland Oil Core it does not burn the core.

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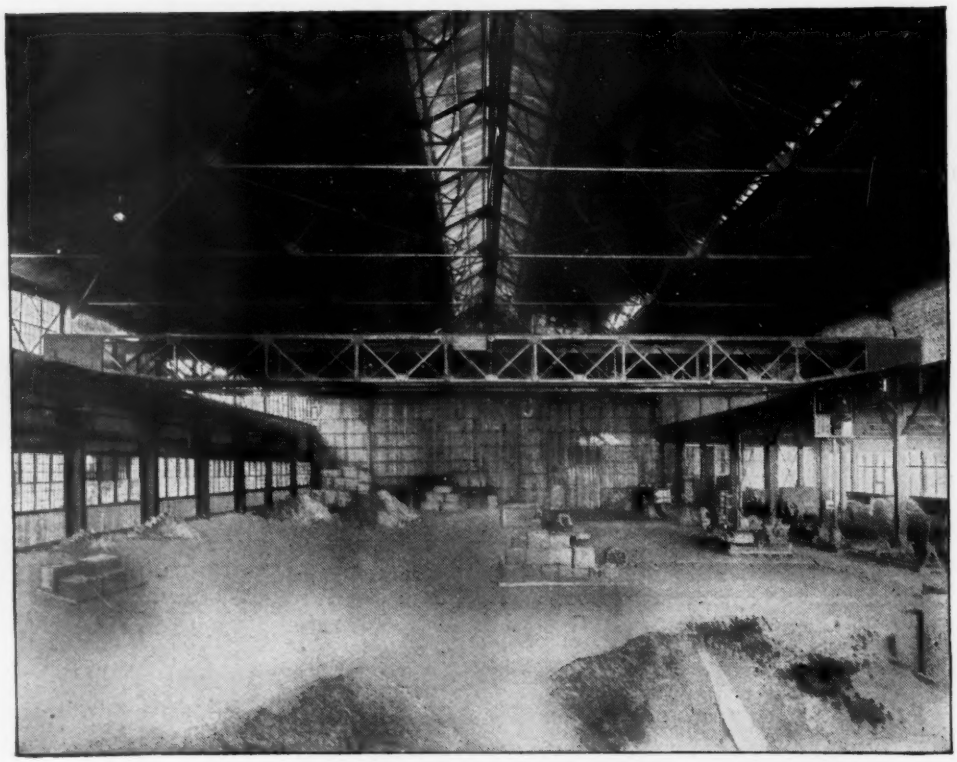

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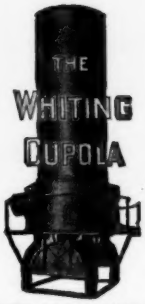

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THE FOUNDRY

Vol. 27, No. 6. CLEVELAND, OHIO, FEBRUARY, 1906. Whole No. 162

Plant of The Providence Steel Casting Co., Providence, R. I.

The question has frequently been asked, Can a steel foundry be conducted with a single converter of the Tropenas type? The Providence Steel Casting Co. has one of the best arranged and most successful plants of this kind that we know of and it certainly shows what can be done with such a plant. The equipment consists of one 2-ton converter, one No. 1 Whiting cupola and one No. 3½ Whiting cupola. The larger cupola is used for melting stock for the converter and the smaller one for melting the material for recarbonizing. There is also a stand upon which the large pouring ladles are placed to be heated by oil previous to pouring and a stand against which the bull ladles are placed for heating. The steel is blown so hot that it is all poured over the lip of the ladle. The pulpit for operating the converter is located opposite the converter, that is, across the main bay of the foundry.

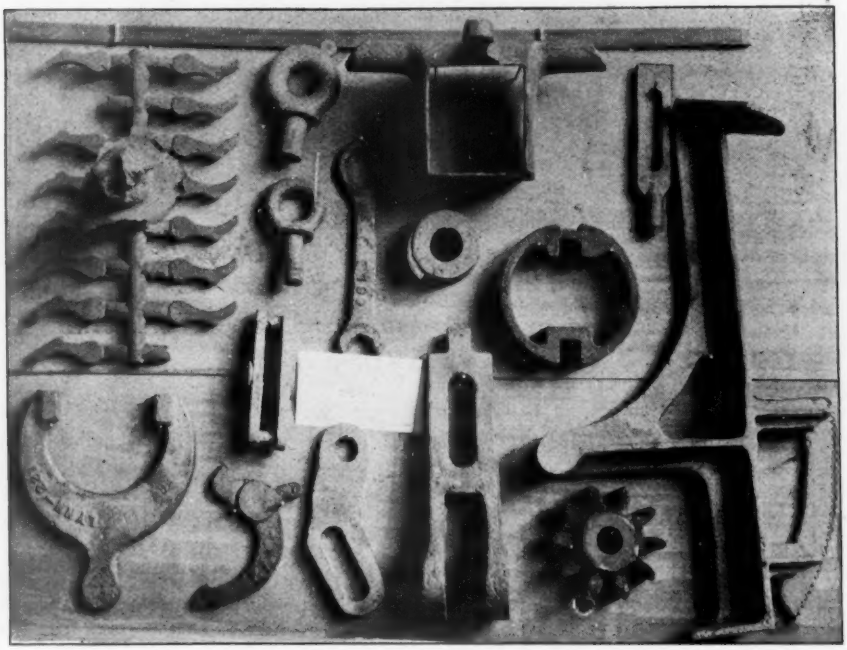
The handling equipment consists of one 10-ton, 50-foot span Shaw crane; one 4-ton jib crane for handling ladles about the cupola; one 1-ton jib crane at the large cutting-off saw, together with special hoisting appliances, at other points where they are needed. The material for the cupolas is taken up by an electric charging elevator, there being two charging platforms, one for the small and one for the large cupola.

CONVERTER AND CUPOLAS.

PART OF MAIN FOUNDRY AND MACHINE DEPARTMENT.

The blast for the cupolas is furnished by one Roots blower and for the converter by a high pressure Roots blower, both being direct connected to General Electric Co. motors.

There are four Wagner cutting-off saws, together with the necessary equipment of machine tools, including saw grinder, drill press, etc. For cleaning the castings there is a sand blast room arranged for

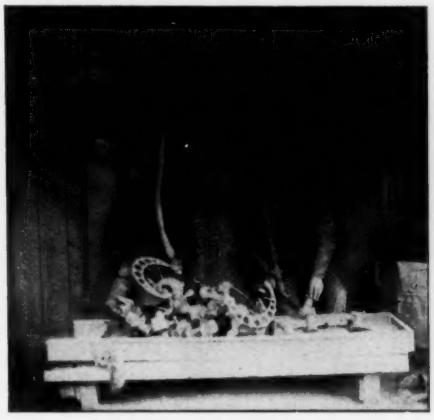


SAMPLE STEEL CASTINGS.

LADLE DRYING RACK.

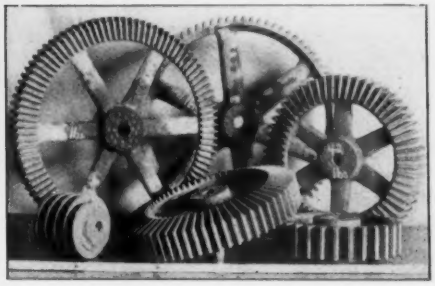
two operators. For welding and repairing there is an electric welding equipment furnished by the Electric Controller & Supply Co., of Cleveland, O.

The power equipment for the foundry consists of two Almy water tube boilers, two high pressure cross compound upright Reeves engines direct connected to 75 kilowatt General Electric Co.'s generators, and one Ingersoll-Sergeant Drill Co.'s air compressor. The foundry is heated by the Sturtevant fan system, using the exhaust steam from the engines.



SAND BLAST CLEANING ROOM.

The company has remarkable shipping facilities, as it has both railroad and water connections, including a good wharf with deep water facilities. One point in the equipment which has been mentioned is worthy of special attention and that is the ladle heating device for heating the small and bull ladles. This consists of a flat plate against which the ladles are placed and heated by an oil flame projected from a hole opposite the center of the ladle. By this device the ladles are brought to a red heat on the inside before the steel is introduced into them, about ten minutes sufficing for the heating.



SOME GOOD STEEL CASTINGS.

The product of the company is well illustrated by some of the accompanying illustrations. One shows a number of

gears, several of which are combined bevel and spur gears. Another illustration shows a group of castings gathered together by the writer and photographed while visiting the plant. The 2-foot rule placed across the top shows the size of the various pieces. The business card in the center of the group was placed there to assist in focusing the camera and also serves as a scale to show the size of some of the pieces. The large casting on the extreme right is made with a notched quadrant, every tooth of which had to be perfect or it would not pass inspection. The gate of small ratchet pawls shown in the upper left-hand corner is partially obscured by the fin on the riser which occurred between the head and the upper face of the cope, but does not in any way interfere with the casting. The company also make heavy castings up to the capacity of the converter.

All of the work of the foundry is kept under the control of the chemist, the plant being equipped with a very complete chemical laboratory.

The officers of the company are Darwin Almy, president; F. W. Hartwell, vice president; C. F. Almy, secretary; L. H. Miller, treasurer and general manager, and A. H. Jameson, superintendent.

MELTING RATIO.

BY JOHN DOYLE.

I see that the old melting ratio pot has boiled over again and the controversy started afresh. This melting ratio business is something which the mathematician would probably call an equation with a good many variables, and if a man leaves out one or two of the variable factors, the results he will obtain by solving the equation will be rather different from those the other fellow gets. Among the important variables are the character of coke, the height of the tuyeres above the bed, the relationship between the area of the tuyeres and the cross section of the cupola, the blast pressure and the height from the tuyeres to the charging door. The size of the coke and the size of the pig and scrap also play an important part in the matter.

Melting has been found to take place in a very narrow zone, which is known as the melting zone and which occurs from 12 to 24 inches above the tuyeres, under ordinary conditions. No matter how the tuyeres of the cupola are arranged, it is impossible to introduce two melting zones, for you cannot have two high temperature spots with a low temperature spot between them in the cupola shaft and have the work progress satisfactorily.

When the cupola is working properly absolutely no solid metal should come within 2 or 3 inches of the bottom of the melting zone and it is better if it can be held a little higher still. The reason for this is that the foundryman wants hot iron and hence the molten iron must be raised above the melting temperature. This means that the metal must pass through the hottest part of the melting zone after it is melted. The temperature at which the metal melts off from the solid scrap or pig does not vary, no matter what the temperature of the melting zone may be, but after fusion has taken place the metal may be superheated. Now the moment the metal becomes fluid it starts for the bottom of the furnace as fast as it can and as a consequence it must be heated very quickly if it is to be heated properly. If too much iron is put on the bed, the bed will burn so low toward the end of the charge that melting will take place at or near the bottom of the melting zone and the result will be dull iron. If the bed is too high at the beginning of the heat, melting will take place in the upper edge of the melting zone, which will result in very slow melting and sometimes in dull iron, on account of the fact that a small amount of iron is chilled in passing the tuyeres and in collecting in the bottom of the cupola before it is tapped.

To have the cupola melt satisfactorily the major part of the melting should take place in the third of the melting zone near its center, that is, no solid iron should come nearer to the bottom of the melting zone than 1/3 of its height and the coke and iron should come down in such proportions as to keep a good supply of metal near the center of the melting zone. Of course, some melting must of necessity take place at the upper edge of the zone, for, as has already been stated, the moment a piece of iron reaches the melting temperature it will begin to melt, but if melting is taking place through 9 or 10 inches of the height of the cupola there will be a very large volume of metal pass-

ing to the hearth and it will come down hot.

The bed charge in the cupola is nothing in the world but a staging or scaffolding for supporting the iron while it is being melted. Only that portion of the fuel above the tuyeres is consumed after the blast is put on and hence the fuel in the lower part of the furnace is liable to become dull and might even become absolutely black if it were not for the constant shower of hot iron passing over it. There is a certain proper height of bed for each cupola and a certain proper charge of coke and iron to be used for each of the succeeding charges. There is also a certain weight of iron which is the maximum that can be melted upon the bed to produce a continuous flow of hot iron.

These factors must be ascertained by experiment for each cupola, as variations in the variables mentioned in the beginning of this article will have a very marked effect upon the matter. When all the factors of the equation happen to be perfectly balanced, phenomenal records are sometimes made, but when we try to repeat these conditions and accurately weigh everything, we are liable to find that the coke was measured and not weighed and as a consequence the melter fooled himself and got in more than he thought. There are many similar errors which creep in.

Hot iron is what the foundryman needs in his business and it is certainly folly to save coke and waste castings. There is one other factor which very few foundrymen recognize and that is, when the high melting ratio is obtained there is always free oxygen in the upper part of the furnace. This results in an excessive oxidation of the iron and in the formation of magnetic oxide. Some of this oxide of iron is mixed with the molten iron, carried into the molds, and while it does not show in the fracture owing to the fact that it is black, it nevertheless very greatly weakens the metal. Good, strong, clean castings can only be obtained by using plenty of coke, and a slight excess of coke maintains a reducing flame and prevents the oxidation of the metal.

If those who are reporting high melting ratios will check matters over carefully we are inclined to believe that they will find that they are fooling themselves in the matter. The writer knows of one foundry where a certain melting ratio has been reported month after month. A cost keeping expert was employed to check over the books and he discovered that one hundred and some odd tons of foundry coke had disappeared during the year according to the records of the cupola man, who had signed receipts for the coke received and had given a report for all that was used.

When the matter was investigated, it was found that a forkful of coke was thrown on each charge for good measure and not reported in the weight. Three cupolas, all of which were in blast almost every day, had soon run up the large error reported. Incidentally, the cost of the castings in this foundry was found to be in excess of the selling price in some cases, when all of the factors were accurately gauged.

In conclusion, the writer believes that the high melting ratio is something like the pot of gold at the end of the rainbow and had better be let alone rather than searched for, as the thing that the foundryman should search for is the hottest possible iron obtainable without the use of an excessive amount of coke.

MULTIPLE CORE-BOXES.

BY H. W. TUTTLE.

Since the introduction of core-oils, for making oil-sand cores, which do not require to be rammed for small cores, but are merely "jarred" down, the "multiple" or "gang" core-box has become very popular. The reason, of course, is that several cores can be made with a multiple box with nearly as much ease as one core with the single box.

While there are several ways of making these boxes, the most accurate, and, when once fitted for it, the cheapest way, is to drill them out on a drill-press.

The pattern required is a plain piece of board of the proper dimensions for half the box. From this two castings are made and fitted with dowel pins. A lead hole is required to guide the drill, so that exactly one-half the core is made in each

half the box. Otherwise the cores would not come out of the box nicely.

If the core print is ⅜ inch or over on the small end, the lead hole should be made with a 5/16 inch drill, this size being stiff enough so that it will not "run" sidewise. In case it be necessary to make a smaller lead hole, it should be drilled carefully, to prevent its running.

The box being spaced so that there shall be ⅛ inch metal between each core, it is placed in a common drill press chuck and the "lead" holes drilled.

To prevent the "lead" drill from "running" more into one-half the box than the other, a piece of common paste-board, the full size of the box, is inserted between the halves before being clamped together.

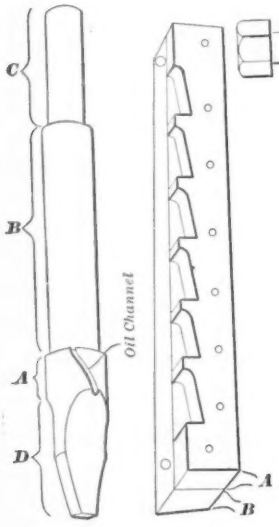


Fig. 1 *Fig. 2* *The Foundry*

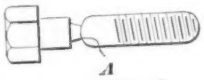


Fig. 3

Fig. 4

After the "lead" holes are drilled the box is taken from the chuck, the paste-board removed, and again clamped.

A drill 1/32 inch or 1/16 inch smaller than the required core is next selected, and the box drilled with it, down to the print.

The box is now finished by reaming with a special drill or reamer, like Fig. 1. A stop on the drill-press is used to get the prints the exact size, and all alike. This reamer may be made on a pattern lathe with a carriage, or in a machine shop. One end of the steel is turned up like the print, but about ¼ inch longer. A part of the shank A, perhaps an inch long is made the diameter of the required core. B is about 1/16 inch smaller, for clearance, and C is made so that it will go into the drill-press chuck.

After being turned, the sides of the print are cut away by a milling machine, or emery wheel, and the reamer sharpened like a flat drill, i. e., by grinding a little clearance back of the cutting edge. An oil channel is cut in on the corner of an emery wheel, it being found that the boxes could be reamed smoother by using oil. After tempering and sharpening, the reamer is ready to use.

If the round steel can be obtained of the proper size, a reamer can be made in a few minutes by hand, by "flatting" the sides on an emery wheel, and then grinding the taper to template.

A reamer may be made of a common twist drill, by grinding the taper and then filing the rake off the cutting edge, just as in fitting a drill for cutting brass. Otherwise the drill will "bite" into the work.

Multiple boxes are generally made up to about 1¼ inch or 1½ inch in diameter and about 4 inches long. Their length is limited to about this, as a core much longer will not stand on end, but will "slump" of its own weight.

Although it is not quite so generally done, "pocket" or "stop off" cores, where the prints are short, are economically made in multiple boxes. Such a core is shown in Fig. 4.

Two patterns are required: one for the core proper and one for the print.

The first is a plain rectangular stick of the proper dimensions (B, Fig. 2). The second is made like A, Fig. 2.

Two castings are made from each pattern. After filing the prints, and fitting, the castings are riveted together like Fig. 2, which shows one-half the box, before drilling.

The reason for casting the parts separately, and afterwards riveting together, is to facilitate the filing.

After the halves of the box are doweled together, the core-hole proper is drilled.

In case the hole is oblong or square, or any shape other than round, it may be made in the pattern, and cast in.

In making the wood pattern for A, Fig. 2 a Forstner bit may be used to good

advantage by clamping two pieces together, and boring in a boring-machine, the half not used being thrown away.

Very convenient and cheap dowel pins may be made like Fig. 3. These are made of stock cap screws, ⅜ inch by about 2 inches.

The tool is ground so that the groove is cut and the corner of the pin rounded at one operation, a stop being used on the lathe to get the proper depth of cut.

It will be noticed that the neck is smallest at the point A. This ensures the twisting off at this point, no further finishing being necessary. The neck should be made large enough so that the thread will be screwed tightly in before the head twists off. 3/16 inch or 7/32 inch will be about right according to how tightly the screw fits the tapped hole.

A convenient chuck for holding these pins when turning, may be made by boring out, while in the lathe, and tapping, a hole in the end of an old lathe center, or any other piece of steel which can be easily centered in the lathe when desired.

Only a few threads near the bottom of the hole should be made, so that the screws may be quickly turned in and out again.

In fitting the boxes with these pins, the halves should be clamped together and drilled 5/16 inch through both halves. The box should then be unclamped and one-half drilled out ⅜ inch. The half with the 5/16 inch holes in is now placed in the vise, in the proper position for tapping, inside up. The other half is now laid on this in the same position as when drilled. The tap is now placed in the ⅜ inch hole in the upper half, to tap the lower half, the upper part serving as a jig to guide the tap. When tapped in this manner, the pins will enter into their corresponding holes, without the fitting so often necessary when the tap doesn't center properly.

A Good Foundry Location.—Mr. S. G. Hunter, of Atlantic, Ia., writes that they have a town of 5,000 where plenty of scrap can be obtained at a low price, but have no foundry, and, in fact, there is no foundry between Des Moines and Council Bluffs. This certainly looks like a good opening for some progressive foundryman.

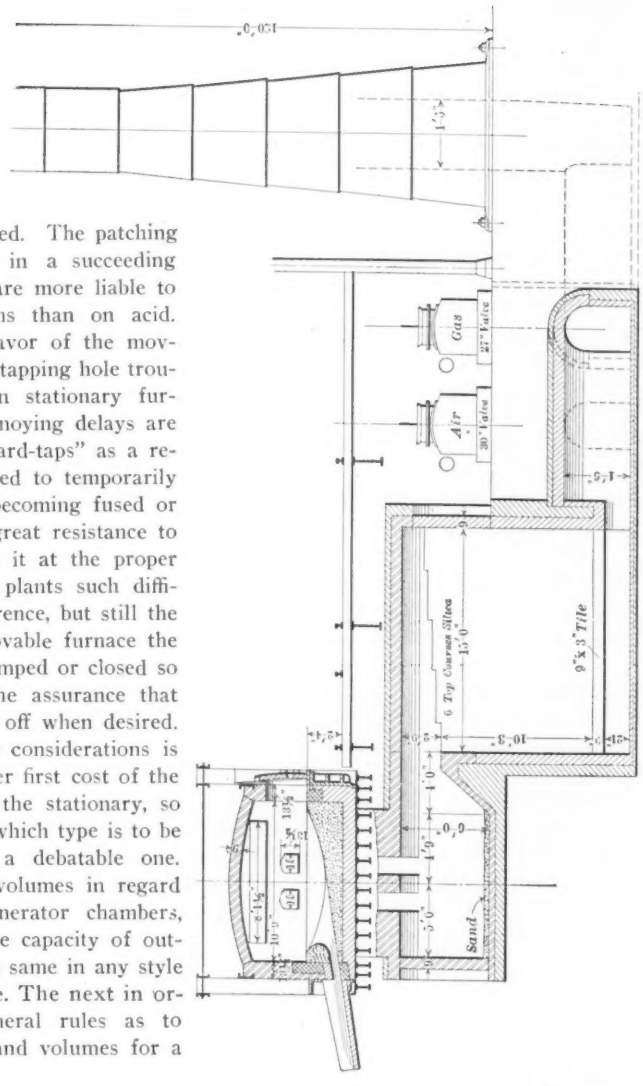
OPEN-HEARTH STEEL CASTINGS.

Furnace Construction.

BY W. M. CARR.

In American practice, when larger tonnages in output are sought, the general capacity of an open-hearth furnace working on castings is about 20 tons per heat. This capacity approaches the maximum that can be economically handled in jobbing shops and will amply represent a general rule. Larger tonnages may be occasionally needed if the class of product is in the shape of heavy work requiring but a few molds to receive a heat of steel and consuming but a moderate interval of time to pour them, but in cases of a heat of steel to be put into a large number of molds the pouring time may be so extended that the metal will lose its temperature. Therefore, charges exceeding 20 tons for miscellaneous castings are apt to result in losses due to cold steel. The cut given herewith shows the usual lines of a modern stationary furnace of 20 tons' capacity. The lines are the ultimate of experience in various plants and embody the best that is obtainable for that type of furnace at the present time. As they are only representative they may be subject to some minor changes which may be dictated by necessities arising from local conditions in erecting. The principles of construction are the same in both acid and basic furnaces, differences occurring in the character of the materials forming the hearth linings. Generally the furnaces are of the stationary type. In some plants will be found furnaces of the rolling or tilting kinds, each having some good points in its favor. From the viewpoint of cheapness of construction the stationary furnace holds the ground. Movable hearth types call for costly mechanical installation not required in stationary units. A potent argument in favor of the movable (rolling or tilting) furnace is the ability offered to completely drain the hearth at the end of a melt thus emptying any pools that may form in the bottom due to excessive scorification and the ease with which they can be readily repaired with proper refractories. In stationary furnaces much time is lost, with much discomfort to the workmen in emp-

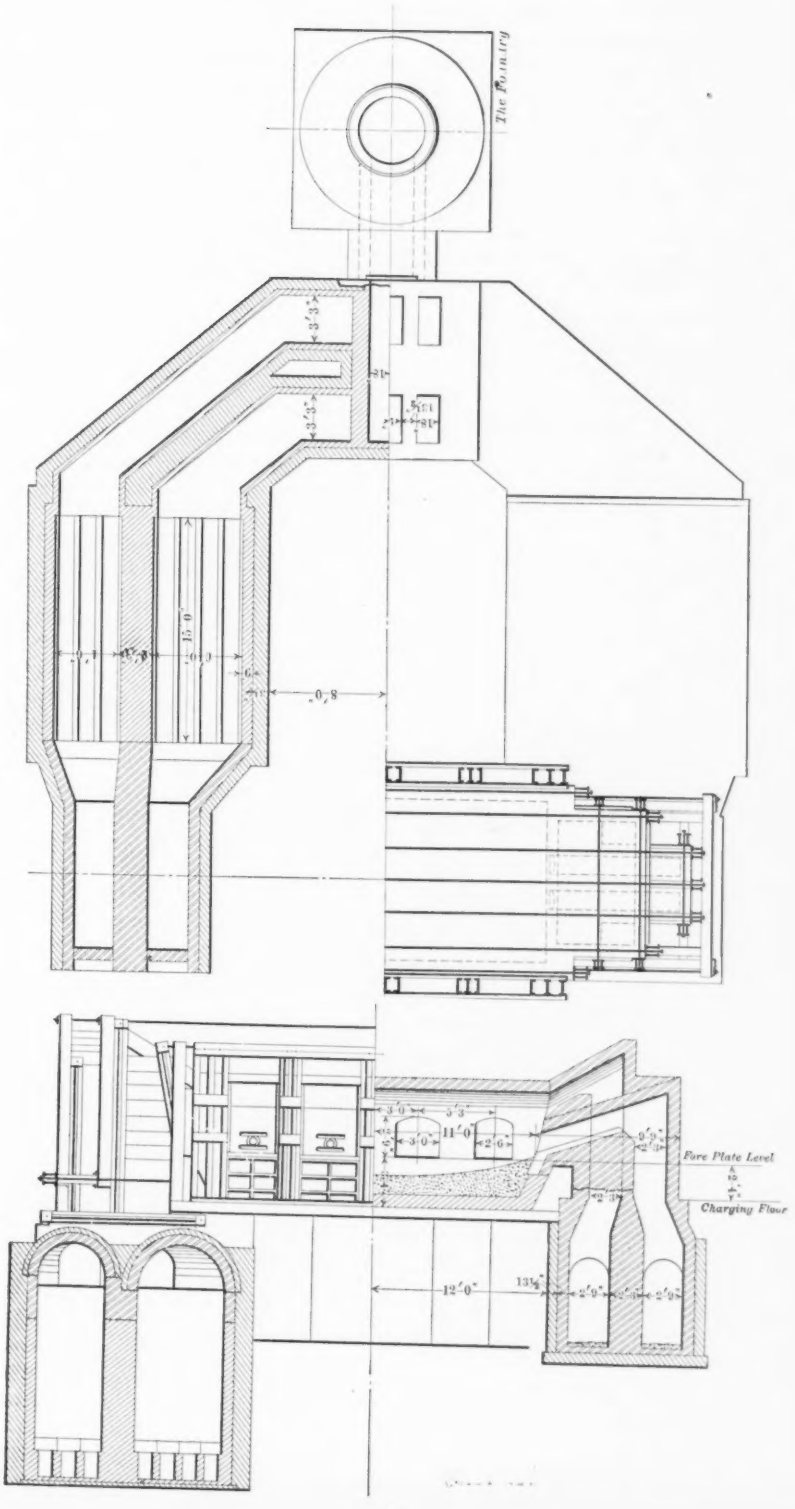
tying pools or "puddles" by means of rabbles or scrapers. They cannot be thoroughly drained by such means and the subsequent patching may or may not be satisfactorily accomplished. The patching may become loosened in a succeeding melt. Such difficulties are more liable to happen in basic bottoms than on acid. Another argument in favor of the movable furnaces is that the tapping hole troubles are eliminated. In stationary furnaces difficulties and annoying delays are encountered through "hard-taps" as a result of the materials used to temporarily close the tapping hole becoming fused or hardened and offering great resistance to tools necessary to open it at the proper time. In well ordered plants such difficulties are a rare occurrence, but still the risk exists. With a movable furnace the tapping hole is never tamped or closed so that there is always the assurance that the metal can be drawn off when desired. Against these favorable considerations is the comparatively heavier first cost of the movable furnaces over the stationary, so that the question as to which type is to be approved will remain a debatable one. However, the relative volumes in regard to hearth area, regenerator chambers, etc., on the basis of the capacity of output per heat will be the same in any style of open-hearth furnace. The next in order will be some general rules as to points of construction and volumes for a 20-ton unit:



First—(Construction.)

The metal work such as buck stays, tie-rods, hearth pan, doors, etc., should be of rigid construction to withstand heavy duty due to brick work expansion when the furnace is at full working heat. All walls should be bound at the ends. Rolled shapes should be used whenever possible. Skew-backs of all arches should be braced by the binding, particularly those of the roof. In the regenerator chambers the ends of all outside or partition walls should be bound, as should the ports because the brick expansion may cause leaks and permit ignition of the gas before it reaches the working body of the furnace. Study well the conditions of subsoil at selected site before putting in foundation. Foundations should be of rigid and of first-class masonry to guard against irregular settling. They should be of hard red brick laid in cement or concrete. No part of the furnace structure should extend below the lowest point at which water may be found. Water is an enemy to smooth furnace operation if it should find its way into flues or chambers. All underground flues not protected by clay should have an outside course of red brick.

Reversing valves should be of such construction that leakages and loss of gas will


The Foundry
Fore Plate Level
Charging Floor

not occur when operated. There are two distinct types, one known as the "butterfly-valve" and another as the "turtle-back." The latter is water sealed, which is an advantage. The stack should be of such construction as will induce a good draught depending upon the damper for regulation.

Whenever possible the doors, door frames and furnace fronts should be water cooled. Features which add to the operator's comfort in watching his furnace. The cost of installation and maintenance may be heavy but will result in a longer life for the parts and a consequent lessening of their repairs offsetting the first cost. This arrangement is only possible on stationary furnaces. On movable ones the piping connections, etc. would be too complicated.

All flues, excepting those leading from the uptakes to the furnace body, should be roomy to prevent choking and cutting by the deposit and heat of waste gases. Roominess is an essential in flues or conduits connecting the gas producers with the regulating and reversing valves and it is good practice to have such conductors above ground the entire distance to allow ready access to clean out unavoidable accumulations of soot and tar. Gas flues or uptakes leading to furnace body should be built with fake arches in their back walls, so that they can be readily repaired when badly cut without disturbing the rest of the furnace. They should also slope towards the hearth so that the incoming gas will be directed downwardly and impinge upon the stock or charge. The air port will also have the same direction, with the gas and air inlets and outlets working properly the sheet of flame will be kept away from the roof and guard against burning or cutting that part.

Second—(Areas and Volumes.)

The hearth length of an open-hearth furnace should be as great as possible in order that the greatest possible benefit be derived from the calorific value of the fuel. An undue shortening would be wasteful because the heat of combustion would be spent in the outgoing and at the sacrifice of fuel consumption and excessive cutting of outlets leading to chambers meaning an increased cost in furnace repairs.

Practical experience has taught that a 20-ton furnace can be safely operated with a hearth length of 20-25 feet and a width of 9-11 feet. The total area of hearth surface will work out to very close to 9 square feet per ton of capacity. The width is limited to a maximum of 15 feet because furnace operatives cannot throw a shovelful of refractory material much over that distance to reach the back-wall. Another is an awkward spring or arched roof with necessary skew-backs to support. Generally the length will be 2-2½ times the width.

The depth of the fully lined hearth will depend upon the dimensions of length and width. A shallow bath will give rapid working but at the sacrifice of much burnt metal or an excessive lowness of yield over metal charged. A deep bath will retard the melting and present difficulties in maintaining desirable thermal conditions. The medium will be learned by the individuality of the furnace and conditions of practice, but to put the problem in figures the ranges for the choice will be between 15 inches to 20 inches of depth.

An important consideration in furnace practice is regenerator chamber volumes. The fuel efficiency will be controlled largely by the length of furnace as mentioned and also upon the proper construction of the chambers. The purposes of them will be subsequently considered. At present attention will be given to their volumes. In that particular there will be conditions to take into account as to how much room can be allowed by the space in the building where the furnace or furnaces may be located both above and below the charging floor and the depth to which the foundations and flues can be safely carried. The efficiency of a regenerator chamber depends upon the number of "checkers" it can carry and the direction of incoming and outgoing gaseous bodies. Direction is meant by the flow of gases whether they be nearly horizontal or nearly vertical in travel.

In American practice the longest dimension of the chambers is horizontal, while in European practice some are built with greater depth than length. It would

seem, in view of the natural tendency of heated gases, to rise that the latter plan is the better, but as stated how they shall be built depends upon variable conditions, however, with a given chamber volume the efficiency varies with the depth. There is quite a range of figures as to volumes of regenerators per ton of capacity with different plants varying from 65 cubic feet to 140. A good figure to work by is 90 cubic feet per ton, allowing 1/3 for gas and 2/3 for air chambers.

If the fuel should be oil or liquid or natural gas the volume can be decreased materially because such varieties of fuel are led directly in the body of the furnace instead of passing through the regenerators, thus offering a possibility of dispensing with the space occupied by regenerators commonly used as ducts for producer gas, but it is better that a furnace be built with an eye to suitability for producer fuel because the supply of liquid fuel or natural gas is subject to possibilities of irregular deliveries and a furnace built only for the latter fuels would cause some annoyance were they to be short. By the same token producers should always be installed as a safeguard no matter what fuel may be regularly used. Thus there would be but little delay to put the producers for gas into service were liquid fuel or natural gas to fail.

The uses of regenerator chambers will next be considered. The purpose is to store in them heat carried over by waste gases produced by the fuel combustion in the furnace body, the heat being absorbed by a large number of No. 1 fire brick, piled in such a manner that the gases in their travel from the body of the furnace to the stack will have to pass through innumerable ducts or passages. Bricks piled in such a manner are called "checkers." The plan is to pile the bricks so that they will form rectangular passages of about 3 to 3½ inches in width. The passages will run horizontally and also vertically. Sometimes they will be in a direct line in both directions, the length and width of the chambers or the bricks may be piled in such a way that the passages are zig-zag or "staggered." Generally they are staggered in a vertical direction with straight passages horizontally.

The question of draught has to be considered and with as many bricks as it may be possible to checker and with the greatest possible depth of chamber the free working of the furnace will be augmented by straight passages in both directions. Indications as to heat absorption by checkers can be gauged by the temperature of the waste gases entering the stack with furnace at full working heat.

Pyrometrical observations by the writer show normal working conditions of stack gases to be an average of 500 degrees C. with gases entering outgoing down-takes at 1,400 degrees C. and with air at atmospheric temperatures entering chambers and passing through them in uptakes at 1,000 degrees C. will suggest the heat absorption and radiation of checkers.

To understand the principle of regeneration it will be clearer in view of the fact that the temperature of flame combustion is not sufficiently high to maintain a continued liquation of a bath of molten metal as its carbon decreases, because the air necessary to support combustion, even with a forced draught, carries away or absorbs the calorific energy of the flame playing upon the bath of metal. In other words cold air lessens the full heating value of flame combustion that should otherwise be spent in work. If, then, the temperature of the necessary air for complete combustion be raised, to that extent will the flame efficiency be increased. On that rests the principle of regeneration.

Let the course of the air be followed in the chambers of an open-hearth furnace passing from left to right. The reversing valves are in position to direct the inflow of gas and air in their respective chambers on the left side of the furnace. Passing through the checkers and innumerable ducts, they enter the uptakes. The gas upon reaching the furnace body immediately ignites and draws upon the accompanying air for complete combustion; the respective volumes of each being under control by the operator. The flame energy being dissipated in work, the waste gases are now drawn by the draught and pushed along by a rear expansion towards the stack but, before reaching it, nearly their entire heat units are absorbed by the checkers in the right-hand set of

chambers. After an interval of 15 to 30 minutes the reversing valves are thrown and the gases are reversed in direction. The air and gas now passing into the already heated right-hand chambers carry back by radiation to the furnace body some of the waste heat previously deposited there to add to heat units produced by flame combustion. The efficiency of the flame will be greater from the right-hand chambers' work, assuming both sets to be of an equal temperature at the beginning of the operation, and after the second reversal the left-hand chamber will bring a still greater increment of heat value than its neighbor. That is to say, the heat units radiated to the incoming air and increasing the flame value necessarily permits more heat for the outgoing checkers to absorb. Thus it will be seen that with the increase in the number of reversals there will also be a gain in heat for work.

It would be possible to melt the best refractories by reaching high ranges of temperature by the principle of regeneration but by careful watching on the part of the operator, flame and air volumes are properly regulated to prevent burning of the furnace. At the same time, enough heat must be maintained during the progress of a melt to preserve the fluidity and proper temperature of a bath of steel at proper intervals. Without the system of regeneration it would not be possible to successfully handle 200 tons or less of liquid steel at a time in a single operation of an open-hearth furnace.

The speed at which the gases travel through the furnace when working is due to both draught and expansion. As soon as the cold incoming air comes in contact with the heated checkers it immediately expands and produces a slight pressure which forces the body of air before it upwardly and entering the furnace body not only assists the combustion of the fuel but washes and protects, so to speak, the roof of the furnace with a film of air and at the same time depresses the flame upon the bath of metal. With free passages in the down-takes and checkers, the stack will readily take care of the waste gases. Obstructions in either would make a slow working furnace and disagreeable waste of flame out of the furnace doors.

Another important feature about regeneration chambers is that they should never be under the furnace body or have their uptakes directly below the ports. In the first instance there would be danger of irregular settling causing cracks in the partition walls between the air and gas chambers, which would allow gas leakages and ignition of same before entering the furnace. In the second place there is always more or less dust and slag carried along by the draught which would be deposited in the checkers with chambers located as just mentioned, thus choking them and, of course, cripple their life. Good practice requires that the chambers be placed at the furnace ends and extend at right angles to them under the charging floor. There should also be spacious receptacles at the lowest point of each downtake to retain accumulations of dust and slag before they could reach the chambers. Such are known as slag pockets and with proper construction they can readily be cleaned out without disturbing the checkers.

A BIT OF HISTORY.

When a man starts into business, he has little idea how far reaching the results of the seemingly unimportant details of his daily work may be, or what strange fields they may lead him into. This is very well illustrated by the experience of Mr. B. F. Sturtevant, founder of the B. F. Sturtevant Co., Boston, Mass.

In 1857, Mr. Sturtevant, a young shoemaker of Norridgwock, Maine, gave up his cobbler's trade, and went to Boston, to introduce and manufacture an ingenious pegging machine, which he had designed to do away with much of the manual labor of pegging shoes. His interest in all that pertained to the manufacture of shoes, led him to introduce other labor saving devices in the same line, and among these, was the buffing wheel for smoothing the soles. The dust created by this machine was one of the objections to its use, until he conceived the idea of drawing the dust away with an

exhaust fan. The only fan which he could obtain, was an exceedingly crude affair, and, as a consequence, he designed and built an improved type of fan. Its success in the removal of dust from the buffing wheel, led to its trial in other fields, including the removal of chips in wood-working machinery, and in the handling of other light material.

From the use of the fan for exhausting material, it was but a short step to its use as a pressure blower for blowing forge fires, boiler fires, and finally for use in connection with the cupola. When it was attempted to use the fan for the production of blast for the cupola, it was found that from ten to fifteen ounces of blast pressure was necessary, and hence, a different type had to be evolved.

Mr. Sturtevant was entirely ignorant of the details of foundry practice or the manufacture of pig iron, but as is often the case, this proved an advantage, rather than an obstacle, to a thorough mastery of the subject, as he came to the problem with no preconceived ideas as to how the result should be accomplished. Utilizing the income from his other business, he undertook an exhaustive series of exeriments, in connection with cupola furnaces. These experiments included the use of many types of fans and blowers, and finally, resulted in the development of what has become known as the steel pressure blower. Naturally, other lines were taken up, for instance, the heating of buildings by forcing air over steam pipes and then into the buildings, and so, the B. F. Sturtevant Co. became one of the best known firms for furnishing equipment for producing blast for cupola and for supplying equipment for heating and ventilating foundries and other buildings. These lines have developed, until today the B. F. Sturtevant Co. have long since been out of the manufacture of shoemaking machinery, and devote their entire attention to other lines of equipment, which have come to include not only the lines mentioned above, but engines, electric equipment, etc.

PHOSPHORUS AND BLOW HOLES.

We recently received a letter from Mr. I. W. Hughes, stating that he heard a chemist state that iron high in phosphorus would make castings show small blow holes when machined. This subject was referred to THE FOUNDRY, and an answer returned stating that phosphorus made iron weak and more fluid, or, at least, prolonged its fluidity, but that it would not cause blow holes.

Later Mr. Hughes inquired of several chemists and they claimed that it was true that phosphorus would produce blow holes, and hence we would like to have the readers of THE FOUNDRY express their opinion upon the subject.

A HIGH MELTING RATIO.

There is an article in the December issue of THE FOUNDRY on a melting ratio, which is surprising to me, as I never could obtain more than a ratio of 7 to 1 and get good hot stove plate iron. Will your reader please tell how he charges his cupola?

My cupola is 52 inches inside the lining, the charging door is 13 feet from the bottom and the tuyeres are 12 inches from the bottom. The tuyeres measure at the inlet, 4 x 12 in., with a partition in the middle, and flare to 16 x 6 inches at the outlet. There are six tuyeres equally spaced. The wind belt is 8 x 14 in. and extends clear around the cupola. We melt from 20,000 to 21,000 pounds of iron per day. The blast pressure is 13 ounces to square inch and the wind pipe 13 inches in diameter.

R. P.

NEW BOOKS.

"The Mechanical World Pocket Diary and Year Book for 1906." 4 x 6¼ inches, bound in cloth, 300 pages, a portion of which is taken up with advertising matter. This book contains valuable matter covering many points in mechanical engineering, just as the previous editions have, and considerable new matter has been added upon the steam turbine and in the electrical section. The book also contains a blank diary for 1906, which is not included in the number of pages given. This useful little handbook is furnished by the publishers in England at 6 pence net.

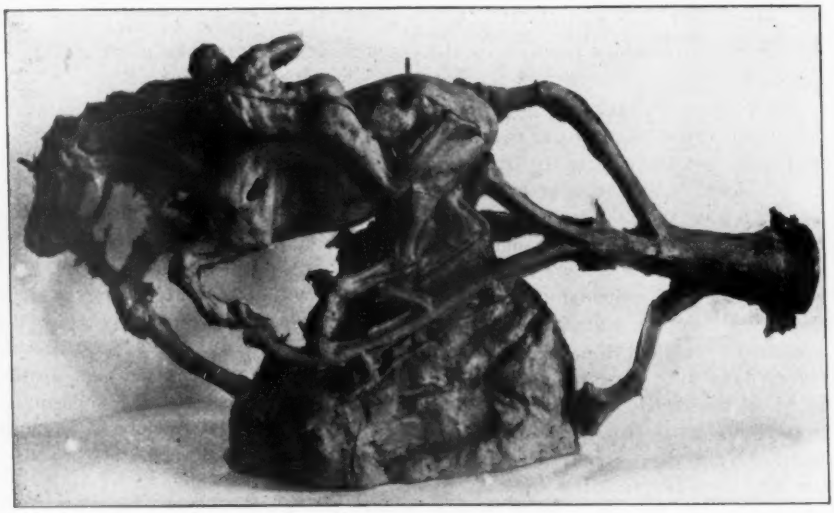
BRASS FOUNDING

THIS DEPARTMENT IS DEVOTED TO THE TREATMENT OF ALL ALLOYS INCLUDING THEIR

FOUNDING, GRINDING, POLISHING, ELECTROPLATING ETC.

STATUARY CASTING DEPARTMENT OF THE GORHAM MFG. CO., PROVIDENCE, R. I.

The statuary molder stands pre-eminent as the artist among molders and his work is radically different from that of the molder producing ordinary commercial castings, but even in this highly specialized artistic branch of the foundry trade modern appliances and equipment are being introduced to assist in handling the material and work in the quickest, cheapest and most expeditious manner. In much of the high art casting work and especially in small figures, the value of the metal becomes insignificant in comparison to the expenditure for labor and hence any saving which can be accomplished by the use of special equipment is important in this branch.



PORTION OF A SMALL REPRODUCTION OF AN EQUESTRIAN STATUE SHOWING GATING SYSTEM.

The Gorham Mfg. Co. operates several foundries or melting departments. The main foundry is that in which statuary is cast and most of the castings are made in bronze. The foundry building proper is 89 x 101 feet and divided into two divisions. The heavy work, or molding floor, is spanned by a 25-ton crane. The largest bronze castings are always divided into several parts for convenience in handling and hence the weight of the metal would never tax a crane of this capacity, but the molds frequently weigh many tons and it is exceedingly important that the mold be lifted without breaking or cracking it. To accomplish this, carefully designed iron flasks are used throughout and the lifting appliances are of the best.

The bronze castings are assembled and fitted in the side bay of the foundry under small jib cranes. These jib cranes are fitted with sections of the Coburn trolley track and differential or triplex chain blocks. The melting equipment consists of a series of coke melting or pot furnaces arranged about

SILVER STATUE AFTER CASTING.

the base of the stack shown in the center of the illustration. The combined capacity of these furnaces is sufficient to cast the largest pieces ever required in the large equestrian statues.

At one end of the room there are two large drying ovens, one 14 feet wide, 14 feet high and 20 feet deep, and the other 14 x 14 x 11. Most of the sand used is known as French sand and is imported. When taken in the hand it feels quite loamy or tacky, but at the same time sharp and fine. This sand has a number of advantages; first, it is so fine that it gives a wonderfully accurate surface. Second, it has very high fire resisting qualities and hence never forms scale or scab when properly handled. Third, when molds are properly dried, it has quite remarkable venting properties. As a rule, no facing whatever is used in a statuary mold and no tool work of any kind is done upon the casting, except the necessary calking of joints. Small castings are usually cast entire, but large ones are divided into several parts for convenience in casting. Even then, there are frequently over 100 parts to the mold. The various little cores or draw backs used for forming the undercut portions are carefully fitted one to another, nailed together and held in position for drying.

The general process of making an art casting, or statue, can be described in a very few words, but the actual production of it is something which requires years of practice and a large amount of experience. No small proportion of the experience comes in the proper placing of the piece in the mold and the cutting of the gates so that the piece runs up sharp in every particular, but at the same time does not crack by drying or shrinking. The intricate gating frequently necessary is well illustrated in one of the accompanying figures, which is a portion of a small reproduction of an equestrian statue. The casting in question, with its gate, is about two feet in length from the horse's head to the end of the gate. It will be noticed that the gate has five principal branches and that these in turn branch to feed various parts of the work. The points at which the gates join the casting proper are always cut down to the smallest possible cross section, so as to enable them to

GENERAL VIEW OF THE STATUARY CASTING DEPARTMENT.

be cut off without injuring the casting.

In making the mold it is always necessary to place a very large number of bars, anchors, etc., in the flask to hold the various cores in position and each of the principal cores or draw backs contains a small wrought iron frame or armature made up by bending rods and wiring, welding or riveting them together. A good idea of some of this rod work can be obtained from some of the accompanying illustrations which were taken from the mold for the silver statue of Columbus which was cast at the Gorham foundry sev-

eral years ago. In the first view, the molding sand has been cut away from the face so as to expose it and several of the wrought iron forms or armatures which support the different cores or draw backs can be seen. In another of the views the exceedingly intricate gate system, together with some of the bars, can be seen. In gating the mold, feeder gates are cut through or between the various cores so as to feed the mold at all points where it is deemed necessary. The presence of a large number of gates outside of the casting also tends to keep the metal fluid long enough to enable it to be fed up sharp. Of course, a mold at the time of pouring is perfectly dry. The finished statue is shown in one of the other views, with the right arm attached. This was cast separate and then secured to the balance of the casting.

In making the mold for the statue, the plaster model is embedded in the sand, the different draw backs and cores being formed about it so that they can be removed one by one to release the model. After the model has been entirely covered with the mold the mold is taken apart, the model removed, the mold re-assembled and a sand core rammed up in it. The mold is then taken apart once more, the sand core removed and pared down to allow for the desired metal thickness. Finally, the mold with the core in place is reassembled and the whole structure thoroughly baked. The gates and principal vent channels are formed during the construction of the mold, most of them being cut in the cores by hand but in some cases wax tapers are introduced and allowed to melt out during the baking process. This is necessary in the case of many complicated gate or vent systems. Great care has to be taken to see that the vent system and the gating system do not join at any point, and also that they are so arranged that no cracks are liable to develop during the drying of the mold which will join the two systems and result in a run out.

During casting the mold has to be clamped very tightly indeed and to accomplish this a large number of bars are placed across the flask and strained up with turn buckles. In the case of a large thin bronze tablet a difference of a few 1-100ths of an inch would make a difference of a great many dollars in the cost of the metal used, and it is by carefully watching these little points and using nothing but the best equipment that the modern bronze foundry is able to turn out the highest possible

GATE SYSTEM FOR SILVER STATUE.

class of art goods and at the same time make a profit, for there is one point in which the artist is on the same plane as the artisan, and that is, that both must make a profit or go out of business.

One thing that interests the heavy work foundryman as he visits a statuary foundry is that there is none of the dust and dirt common even in many brass and bronze foundries, for from the very nature of the work it must not be done in a hurry, and tumbling barrels, sand blast, grinding wheels,

etc., would be sadly out of place in an art foundry.

Much of the artistic silverware in the shape of fine plate, buckles, silver ladles, cups and other similar pieces are cast and for the manufacture of this class of goods the Gorham Co. have a foundry known as their silver foundry, in which silver and German silver are cast. Most of the work is done in small iron flasks as bench molding. Many of the patterns are mounted

SILVER STATUE OF COLUMBUS.

on gates but the most intricate ones and the special designs are all handled separately. In this department French sand and Birmingham loam, the latter being imported from England, are both used. There is also a department for casting by a special process, the patents for which are controlled by the Gorham Co. The molds for this department are exceedingly delicate and are made from a composition capable of producing a very high finish and at the same time resisting the high temperature of the molten silver.

There is also a melting room in which the silver plates or bars for rolling are cast, but this work can hardly be called founding and is more akin to the casting of high grade ingots. It requires great skill, however, to always produce metal which will work well in the rolls and presses.

The Gorham Mfg. Co. has been in existence over eighty years and judging by the present output of the factory they are likely to stay in the lead as long as the firm continues in business.

THE NOTATION OF ALLOYS. A PROBLEM FOR METALLURGISTS.

BY JOHN F. BUCHANAN.

The notation in common use for distinguishing the various metallurgic products is, for the most part, a promiscuous growth of popular or local characterizations, private marks and industrial apothegms. The quality of the useful metals, iron, copper, tin, zinc, etc., is generally indicated by the brands or grade numbers of the manufacturers. These markings may be useful in commercial quarters for fixing a basis price in each class, but in the actual founding of metals they are of no practical value. Such marks as *"best," "best best," "treble best," "tough" and "G. M. B.'s* (good merchantable brands) are supposed to give the buyer a clue to the quality of metals, but in reality they only indicate the relative qualities of the productions of each individual maker. The *"best best"* of one maker may be no better than the *"best"* of another; and the analyses of *"best selected"* copper ingots, "Virgin" zinc, or "refined" tin, varies with the mines and the extraction processes from which they are evolved. The marking of metals, then, fixes no standard of quality; the crowns and crosses, the lions and the lambs which are impressed on them, are used for the same reason as "3 stars" are adopted for certain brandies,—for advertising purposes. But something more than a trade mark or a market brand is needed to guide the purchaser of alloys, therefore it is becoming the custom to stipulate the percentage of the princi-

pal elements contained in modern alloys. For instance, by "genuine" babbitt metal, an alloy containing not less than 80 per cent of tin is understood, and in brass foundry parlance "yellow metal" signifies a copper and zinc alloy in which the proportion of zinc does not exceed one-third of the mixture. Vocabularies are made up of names, numerals and *nuances;* but the vocabulary of the metal trades is notorious for its numerous inappropriate names, meaningless signs and misleading catch-words. The ceremony of bestowing a name upon anything is always regarded as being of great importance. Babies and ships are christened, churches are consecrated, hospitals are dedicated, memorials are erected, patents are granted and territories are claimed and proclaimed only when the initial ceremony of naming has been accomplished. Whatever formalities may take place at these occasions, the general interest is centered in the name which is bestowed. A name should, as nearly as possible, focus the purport or the properties of the object named.

There is much to be learned from names, when they are properly applied, but a misnomer is always a snare to the tyro and a worry to the scientist. "What's in a name?" is as difficult a question to settle as—What's without a name? One cannot give utterance to a thought or single out one thing from every other thing, until he has invested it with a suitable appellation. The metal trade is handicapped by having two sets of terms—the commercial and the scientific—to distinguish the goods, and in the matter of alloys, or mixed metals, the long list of oracular, informal and arbitrary titles which have been adopted within the last half century, has got beyond the capacity of the average metal worker. The beauty of chemical nomenclature is, that it always supplies accurate information. It is qualitative and quantitative, for it tells the nature of a compound and also the proportions of its elements. H_2SO_4 is a definite substance to the chemist. When he sees the familiar formula he not only thinks of sulphuric acid, but, instinctively, he makes a mental note of the order and relationship of the constituents. How different is the system by which the metallic alloys are formulated! Granted that the alloys which form true chemical compounds are comparatively few, there is no reason why the components and proportions of even the most intricate alloys should not be graphically stated. Chemical notation can only be applied to alloys when the metals combine in atomic proportions to form chemical compounds, and it would be difficult for metallurgists to devise a systematic nomenclature for alloys with anything like the simplicity and comprehensiveness of the chemical method of designating salts, etc. We long, however, for some more rational method of naming alloys than the happy-go-lucky system now in vogue. The bewildering array of names, which are allowed to be applied to alloys which are the same in substance, is a disgrace to an industry based on scientific principles. Metallurgy is probably the most comprehensive of applied sciences and the names given to the metals belong to all ages and countries. Whatever name has been chosen for a metal, the Latin form of it has been generally adopted for technical purposes. If metallurgists could devise a similar system for naming the metallic alloys, they would bring order out of chaos, make it easier to marshall the mixed metals into groups, and less difficult to understand what are the essential elements in any particular class of alloys.

Uniformity is the life of science,—but there is no uniformity in the metallic hurly-burly. Alloys are seldom what they are represented to be. Gun metal for ordnance is obsolete, but the name survives. Phosphor bronze (which was originally an alloy of copper, tin and phosphorus), has been modified and altered beyond recognition as a bronze. Copper and lead are frequently the principal components of so-called phosphor bronzes, the phosphide of tin being conspicuous for its scarcity. "Platinoid" is a high resistance (electrical) alloy, which is innocent of platinum. Aluminum bronze as it is now made, is not the unique alloy which promised so well some years ago; a pinchbeck variety has supplanted the genuine alloy, but, to avoid confusion, it should be called aluminum brass. It is in reality ordinary brass, containing from 1 to 2 per cent aluminum. Exam-

ples of this sort of thing could be multiplied *ad lib.* The metals have been named in all sorts of ways. The alchemists fancied some metals male, others female. Arsenic is derived from the Greek word for male. Some of the metals are named after gods, goddesses and stars, as, *Titan*-ium, *Thor*-ium *Mercury,* etc.; others derive their names from the countries in which they were first discovered—*Cu-prum,* (Cypress), *Germanium, Gallium,* but the origin of names for alloys is too obscure for elucidation. Sometimes an alloy is named after its inventor, as Muntz metal; sometimes after the inventor's initial, as Delta, the Greek letter beginning the name of Mr. Dick; sometimes the inventor disguises his identity and the nature of the alloy by a Latin suffix, as "partinium;" sometimes by a figurative title, as "atlas" bronze, "glacier" metal, etc. But the most common names for alloys have been illustrative of the uses for which they are suited. Such names as, anti-friction metal, steam metal, button metal, type metal, fusible metal, convey to the metal worker a general idea of the properties of the respective alloys. But none of these metals have been standardized and every manufacturer makes them according to his own impression of the requirements. Again, alloys are usually classified according to their densities, or by their most important or predominant constituent, as, copper alloys, aluminum alloys (light and heavy), tin alloys, etc. In many instances the names and the classification are at variance. White metal, for example, may mean a copper alloy containing zinc and nickel, or it may mean a tin or zinc alloy for bearings or patterns. Anti-friction alloys are known to the trade by these amongst many other titles, viz.: *babbitt* metal, *bearing* metal, *fusible* metal, *patent* metal, *plastic* metal, *white* metal and *anti-attrition* metal. Again, take German silver, alloys. In addition to the standard compositions in use in industrial countries for the manufacture of tableware and coins, known as German silver and nickel alloys, respectively, the brass founder recognizes a host of other products in the same class, under a grotesque variety of names, as, *albata, argitan, argusoid, sil-*

TABLE I.

NAME	COMPOSITION	PROPOSED FORMULA
Bell Metal	Copper 80 parts. Tin 20 parts	Cu-stan. (80. 20.)
Gun Metal	Copper 88 parts. Tin 10 parts. Zinc 2 parts	Cu-stan-zi. (88. 10. 2.)
Steam Metal	Copper 86 parts. Tin 6 parts. Zinc 6 p. Lead 2 p.	Cu-stan-zi-plum. (86. 6. 6. 2.)
Yellow Metal	Copper 70 parts. Zinc 30 parts	Cu-zi. (70. 30.)
German Silver	Copper 50 parts. Zinc 25 parts. Nickel 25 parts	Cu-zi-nick. (50. 25. 25.)
Plumbers' Solder	Lead 2 parts. Tin 1 part	Plum-stan. (2. 1.)
Bearing Bronze	Copper 80 parts. Tin 10 parts. Lead 9 p. Phosphorus 1 p.	Phos-cu-stan-plum. (1. 80. 10. 9.)
Type Metal	Lead 80 parts. Antimony 20 parts	Plum-stib. (80. 20.)
Silicon Bronze	Copper 90 parts. Tin 8 parts. Silicon 2 parts	Sil-cu-stan. (2. 90. 8.)

veroid, silverette, packfong, biddery, etc.

These examples serve to show how ambiguous the names conferred on alloys may be; how contradictory, how unnecessary; but they by no means exhaust the terms descriptive of anti-friction or German silver alloys. The dictionaries and technical and classical literature have been ransacked by makers and advertisers of alloys for names for their wares. Hundreds of catchy, high-sounding names have been registered; and there is quite a flood of superfluous appellations to be dispelled before anything like a systematic nomenclature, or notation of alloys, can be unfolded.

Chemists formulate chemical compounds by the symbols of the elements present and by their atomic relations, the latter being indicated by the numerals attached to the symbols. This system is not suited for the majority of the alloys, because they rarely combine to form true chemical compounds, and the complex nature of some allotropic compounds would give rise to irregularities. What *practical* metallurgists need is a systematic notation for alloys (even if they are mechanical mixtures), based on the proportions of the components. This would embrace all possible compounds of elementary substances and include that large and important class of scientifically nondescript compounds termed the metallic alloys. There is too much mystery about alloys altogether; they are enveloped in scientific fog and manufactured in accordance with the tenets of some secret societies. I submit that there is as much need for an *Alloys Act*, as there is for a *Food and Drugs Act*, in our legislative administrations, since human lives are sometimes dependent on the quality of metals.

The cue to the construction of a notation for alloys is contained in the statement already made, namely, that most of the useful alloys do not enter into true chemical combination, but are simply mixtures of metals which have the power of cohesion at ordinary temperatures.

Atomic formulæ can only be used for *dual alloys which form perfect compounds*, as, for example: Ag_3Cu_2 or $Sn\ Cu_3$; but it rarely happens that these chemical alloys of two metals are of any practical value in the arts. Many of the most useful alloys contain three or four elements which are essential to their composition, therefore a system of linking the symbols and the ratios of the contents is required to explain these complications. To follow the chemical usage and connect figures to the symbols would be confusing and altogether an erroneous proceeding. Such figures would indicate chemical equivalents where they did not exist. To get over the difficulty and for the sake of euphony, the first syllable of the technical name of each metal contained in the alloy could be taken to form a composite word which would give a clear and unmistakable intimation of the components. In this way brass would be represented by *cu-zi* and if the exact amount of each element should be known, the parts could be indicated by figures thus, $cu_{67}zi_{33}$. Further, if the brass contained lead, as in cock metal, the formula would become *cu-zi-plum*, or if it contained tin, as in naval brass, it would be *cu-zi-stan;* with aluminum or any of the earthy metals or metalloids, the first place would be assigned to the least metallic element, as, *phos-cu-stan* (phosphor bronze), *al-cu-zi* (aluminum brass), etc. This notation may not be based on science, but it would be eminently practical in manufacturing circles. It would become a kind of metallurgic shorthand for alloys and the metal worker could then understand the composition and get a general idea of the properties of the material at a glance. Table 1 gives some examples of standard formulae for comparison.

ACID DIPS AND PICKLES FOR BRASS CASTINGS.

BY H. J. HAWKINS.

Many brass founders, I think, are not familiar with the many uses to which several acids are adapted in the manufacture of cast brass goods. Hydrofluoric, nitric and sulphuric acids are well nigh indispensable in the up-to-date brass shops. Used as a cleaning agent and also as a finishing process, there is nothing than can supplant them. If it was more generally known, by actual experience, what time and labor savers these acids are

when properly used, they would, I think, be in more general use. True, most, if not all, foundries, both large and small, use the acid dips to a certain extent, but the acid is not made or given a chance to accomplish all that it could do to an advantage in the way of cleaning and finishing castings. There is too much dependence put upon the slow process of tumbling in cleaning castings which requires many hours to remove the sand and scale from the work and then it is only imperfectly done, while the same could be accomplished in a few minutes by the use of the hydrofluoric pickle. The result of this operation is sure, that is, you are certain, when the work is properly pickled, that it will come from the solution free from all scale and sand, which is the object of pickling or tumbling.

Hydrofluoric acid as a cleaning agent for castings has not been in general use for any great length of time, and a few years ago was treated as a secret process by those who understood its value and made use of it in removing sand from castings.

Several formulae have been sold for this pickle for considerable sums, said formula having several superfluous ingredients in them to mystify the unsuspecting buyer. But the fact is anything used in connection with this pickle beside hydrofluoric acid and water are entirely unnecessary. The usual formula for removing sand from brass castings is hydrofluoric acid 1 part and water 10 parts.

It must be remembered, however, that this acid comes in different degrees of purity, if the weaker acid is used, less water is added to the dip, if the stronger grades are used, more water should be added, but there is no set rule as to the exact amount of acid to be used. The idea is to get a dip that will remove the sand quickly and perfectly from the casting; this operation usually requires from ten to fifteen minutes, depending entirely upon the amount of sand to be removed and the condition of the pickle; of course, a newly made pickle works much faster and cleaner than one that has been in use for some time.

Where large quantities of castings are pickled, the bottom of the tank containing the pickle should be frequently cleaned out, as there will be large deposits of sediment in the bottom caused by the acids dissolving the sand from the castings, large work should be handled with hooks or tongues, while smaller work can be placed in iron or brass wire baskets and is easily handled in this way.

After all the sand has been removed the work should be well swilled in cold running water, then run through boiling hot water and shaken, it will then dry off clean in a few moments.

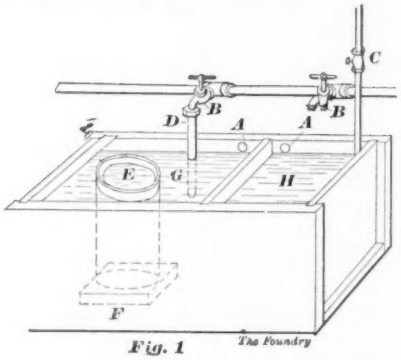


Fig. 1

Much caution should be used in making the tank to contain this hydrofluoric pickle; unlike other acid dips it cannot be contained in glass or earthen vessels, but must be kept in gutta percha or asphaltum lined tanks; lead lined tanks are sometimes used or a good tight oak tank with no lining whatever will answer the purpose very well. The proper place for the pickling operation would be in an outside shed, if convenient, or under a skylight or near an open window or other place with good ventilation, as the fumes from a strong hydrofluoric pickle are very disagreeable. Care should be taken also that the strong acid does not come in contact with the bare skin, as it is liable to cause sores.

What is known to the trade as bright dip is absolutely indispensable in the manufacture of brass goods; this dip will be found in connection with every brass foundry, large or small, and has been in use a great many years. It has never been improved upon as far as the results are concerned, but is always found a very disagreeable and unhealthy solution to work over and where it is required to dip large quantities of work special facilities

should be arranged to carry off the fumes.

Where first-class work is expected and required it is of the utmost importance to have the dipping arrangements as nearly perfect as may be. A very simple and convenient arrangement is shown in Fig. 1.

This cut shows a simple and very convenient arrangement for acid dipping. The tank should be made of good pine, free from knots, or oak and well bolted. Line the cold water compartment G with asphaltum inside and the whole tank should be well pitched on the outside, leaving the inside of part H to contain the hot water free from pitch. The clean water should be carried to bottom of tank by means of hose D, allowing the dirty water to be carried off by the discharge pipe A, the top of which should be about 4 inches below the top of tank. A wooden hood should be built over this tank to carry off the fumes. The water in H is heated by steam from the pipe C.

The standard formula for the bright dip for brass work is as follows: Sulphuric acid four gals., nitric acid two gals., stirring in a small handful of salt using a glass rod for stirring. Sometimes an ounce or two of lamp black is added to this dip with beneficial results seen in the finish obtained on the work.

This dip should be kept as free from water as possible, as water weakens it and causes it to lose its activity. It is the general practice in dipping brass castings to dip them directly from the cold water into the acid dip. This is wrong; the work should go into the bright dip dry or nearly so. It is the best method to run the work through the hot water in H, shake off then into the bright dip in E. In this way the work will go into the dip dry or nearly so, thereby increasing the life of the dip. Some work, especially new castings, must be dipped twice and often three times, where a fine even color is required. After dipping, rinse quickly in cold, then hot water, and dry in sawdust, using "hardwood sawdust."

I will now mention a new bright dip that so far as the quality of work produced is perhaps not equal to the one just mentioned, but it has the advantage of being fumeless, which is a great convenience to the operator, and where highly finished work is not required answers every requirement. Formula:

Sulphuric acid	10 lbs.
Saltpetre	2 lbs.
Water	5 lbs.

In making up an acid dip always add the acid to the water slowly, never under any circumstances add the water to the acid.

This formula just given works best after being used for some time and as I said before, it has the very good feature of being fumeless or nearly so, therefore does not require to be so well ventilated as does the other dip.

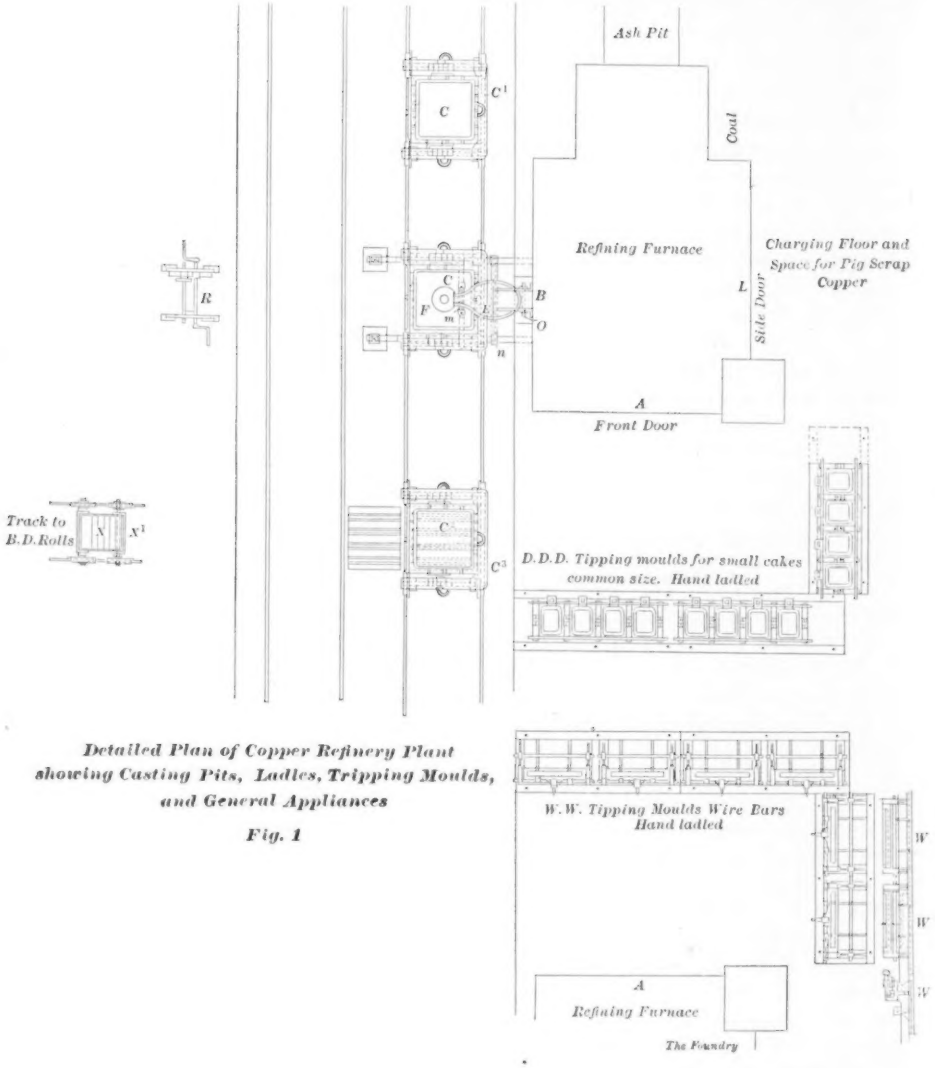
COPPER REFINERY PLANT FOR MARTIN'S DIRECT ROLLING PROCESS.

BY H. J. MARTIN.

In the direct rolling process for the manufacture of copper plates, sheets or bars, etc., the salient feature consists of the utilization of the heat still contained in the cakes or wire bars immediately after they are cast and become solidified in the refinery. Special tipping molds being used for facilitating the stripping and rapid removal of the hot cakes or bars therefrom, the inherent heat in these refinery products being immediately utilized for carrying out the ordinary roughing or "breaking-down" rolling operation direct from the refinery, instead of allowing them to cool down after being cast and then subsequently reheating them in heating furnaces, as is now practiced and obligatory.

In certain classes of mill requirements where there is a large run of work of one size, the second rolling stage or "drawing-on" might also be still further performed on the products, if deemed advisable, by means of this same heat. For the bulk of general work, however, it may perhaps be found preferable to fully accomplish the first rolling operation only, then to cool the plates and afterwards inspecting and removing any defects before shearing them into pieces for the "finishing" rolls.

From the above it will be seen that considerable economy must be effected by doing away with so much of the reheating



Detailed Plan of Copper Refinery Plant showing Casting Pits, Ladles, Tripping Moulds, and General Appliances

Fig. 1

now required with its attendant risks of overheating and waste in oxidation, etc., as well as other serious disadvantages. Among the various advantages claimed for the process, one of the most important is the avoidance to a great extent of the deleterious effects due to porosity in the cakes and bars after they are cast and got cold, this generally showing itself in the shape of blowholes, pinholes, piping or coldsets, and the consequent production of sounder metal, principally due to the great pressure it is subjected to, whilst it is still in a soft or semi-plastic condition and which has the effect of bringing about the elimination of the above grave defects by welding up the walls of such cavities and thoroughly consolidating the particles of the metal together.

Various arrangements may be adopted in the design of the copper refinery for carrying out the direct rolling process and installing the special tipping molds which are necessary for facilitating the same, but about the best form and one which possesses the merit of being extremely simple is the arrangement here described and recommended and shown in the annexed plan and elevations, Figs. 1, 2, and 3. The complete arrangement can be easily applied to existing refineries, and at the same time it possesses the ad-

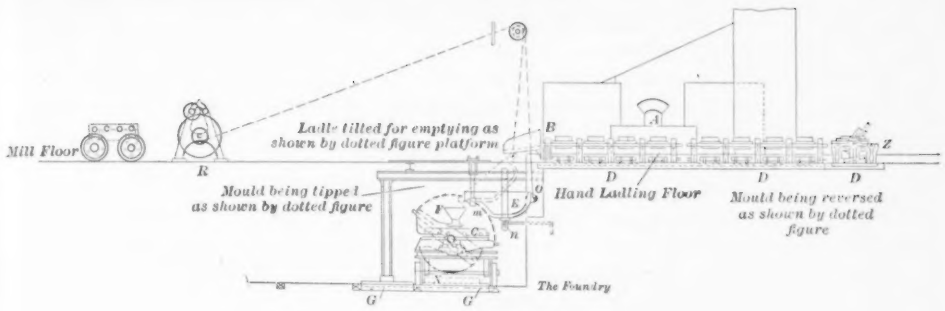


Fig. 2

vantage of enabling the whole of the casting operations to be performed by manual labor so that the installation, in the refinery, of expensive mechanical power and appliances can be dispensed with, if not desired. Moreover, it will be seen that, in this method, advantage is also taken of the benefits and economy to be derived by adopting the system of tapping from the furnace for all the larger masses of copper turned out and thus doing away with the tedious, arduous and often at times intolerable operation of handladling of these products, now practiced. The result being that the charge of the refining furnace is emptied with far greater celerity and ease than hitherto and also in consequence with far less liability to variation of the pitch of the copper in the bath of the furnace, by becoming "dry" or underpitch.

It will be seen by the plan that this arrangement provides for the use of a big stationary ladle, which is anchored at its front end immediately underneath the lip and occupies a permanent position under the taphole spout. The flow of the metal from the taphole into the ladle being continuous and the pouring from the ladle into the molds being done intermittently at the will of the operator. All large molds such as are suitable for heavy cakes or bars are mounted on cars or bogies and being thus movable are run up under the lip of the ladle for the purpose of receiving the molten metal. The figures show the casting pit on one side of the furnace and also the big ladle and general appliances in connection therewith.

It will also be observed that it is proposed to still carry on, in addition, the present system of handladling from the front door A, for all the smaller masses of copper such as the usual common size cakes, which would be ladled into the molds marked D, or light wirebars into molds W. These, perhaps, can be turned out much cleaner, without splashing, etc., in this way than by mechanical means. But as before stated, all the larger masses of copper, such as heavy cakes and bars, would be poured from the big spoon-shaped ladle E, which is itself filled by a regulated and continuously flowing stream of molten metal from the taphole B in the furnace side. This ladle is pivoted just underneath the lip, in the suspended bearings M and when it is desired to pour from it, say into the large molds C the back end of the ladle at O is merely lifted by means of a wire rope suspended from over a sheave and attached to the winch R; of course if hydraulic power be available, it might be found preferable to attach the rope to a piston working in a hydraulic cylinder. When the pouring is completed, indicated by the level of the metal in the molds reaching a mark giving the requisite thickness for the cake, then the back end O is instantly lowered and the pouring stopped, but the still running stream from the furnace would now go on replenishing the ladle for the next cake. If however an extra thick cake should require more metal than the big ladle contains, then the back end O is merely kept up for awhile until the extra quantity is run in as the stream from the taphole would in that case be directed towards the inclined lip, straight into the mold the back end being then lowered the ladle then comes on to its rest, the crossbar N, and thus the hottest metal is got into the cake right up to the very last. The crossbar is hung from the I beams above and the hangers having

the bearings M at their extremities for pivoting the front end, are also suspended.

It will be obvious that the above arrangement ensures a constant addition of fresh heat, above the melting point temperature, to the molten metal in the ladle from the continuously flowing stream straight from the furnace and thus congealing or chilling of the copper is avoided, this being a difficulty formerly often encountered in attempts at tapping metallic copper; much loss of heat may also be prevented by giving the surface

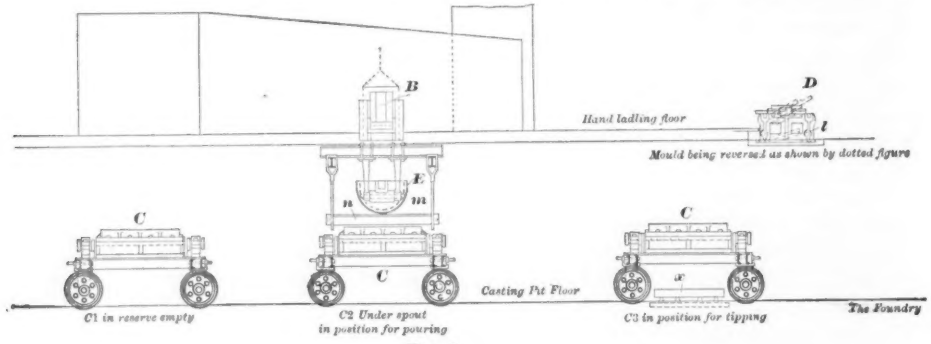


Fig. 3

in the ladle a cover of charcoal, when necessary. It will be noticed that during the movements of lifting and lowering the back end O of the ladle, that the ladle lip only varies very slightly in position fall of metal need only be given, thus and so being nearly constant a very short splashing, etc., in the mold is avoided. The proper control necessary for pouring from the ladle, also, is not in the least interfered with by the simultaneous filling of same with metal from the taphole, all being done with the greatest facility.

When a large cake has been cast, a slight interval of rest is given it before the bogie is moved, so that a crust may form; it is then pushed out from the lip towards the tipping place C3 and another empty one held in reserve, as shown at C1, is moved in to take its place under the ladle lip. Meantime the mold C3 at the tipping place is tipped by simply giving it half a turn on its trunnions by means of a jib crane and the hot cake would drop out, as shown at X onto a heavy dumping plate G, situated underneath, whence it would be lifted with as little delay as possible onto a mill car K, which runs on a short track, as indicated by the arrow, straight to the "breaking-down" rolls, which should be in close proximity and where the rolling of the cake would be immediately proceeded with, thus taking full advantage of its inherent heat still left from its original molten condition of the refinery.

The metal might be either poured direct into the mold, or if found preferable and to preserve as unruffled a surface as possible on the cake, it may be first poured into the funnel F, this latter being provided with a baffle plate at its bottom, which causes the metal to be gently distributed to all points of the mold until up to the mark. With the funnel the metal may be poured from the ladle in a much larger body and the cake then cast more rapidly, thus avoiding cold sets, which are so liable to occur by the old system of hand-ladling when casting and "floating" these large cakes, in consequence of the large area exposed and also the metal in the mold being only augmented by the small quantities carried in the ordinary hand-ladle.

Thus the procession of cars would go on one after the other receiving the molten metal from the big ladle, the furnace being thus emptied with far greater rapidity than by the usual practice of hand-ladling. One very essential and valuable feature in the use of these bogies being their perfect freedom and independence of movement as compared with the arbitrary motion of mechanical appliances and also the fact of storage room being provided between the various positions, so that in case of any interruption in the pouring through mishap or delay in supplying empty bogies, or a block in either of the operations from whatever cause

and the ladle perhaps in the meanwhile filling up and no empty molds immediately available, then the flow from the taphole may be easily checked for a while or stopped altogether by the furnaceman in charge.

As has been shown, the large cakes and bars before mentioned would be produced by the more economical method of tapping from the furnace and these might be more generally used for the bulk of the various classes of millwork, as, of course, they would suit for either large or small requirements, merely requiring shearing to suitable dimensions. Thus the small masses which would require hand-ladling might be almost abolished, or at least, only be produced to suit special requirements and so hand-ladling from the front door need not be carried on to any great extent, at any rate merely for a small proportion of the furnace charge, thus reducing this tedious operation to a minimum. But, as before stated, when their production is necessary, these smaller cakes or light wirebars would be ladled by hand from the front door A into the small tipping cake molds D, or wire bar molds W, from which they would be readily tipped by hand by simply giving them half a turn on their trunnions, the cake would then drop out onto the small stool underneath (and the cake mold being reversible would be thus ready to receive the next cake on its upper side), thence whilst still hot, the cake would be withdrawn over the roller Z onto a light hand car and conveyed without delay to the breaking-down rolls and there rolled by the rollerman and his assistants, who would now be saved the labor and trouble of looking after and attending to heating furnaces, as well as saving the great cost for their upkeep in fuel, etc.

For tipping the large molds C and afterwards lifting the heavy cakes out of the casting pit, an ordinary jib crane with a racking top block might be used, or if an overhead traveling crane were installed for doing this work, it could also be made to command the small fixed molds D and W and thus facilitate the work of changing these latter to suit various requirements or for renewals, the same bedplates being made suitable for all small size molds, i. e., for common cakes, wire bars or bar ingots, these being readily tipped by hand, the impact of the full mold striking on the crossbars when tipping tending to loosen the cakes or bars should they have any tendency to stick, this being further prevented by the usual preparatory wash of wood or bone ash or charcoal, as well as the slight taper in the mold sides. The whole of the molds, both large and small, are, in addition, provided with bottom plates of copper which have the effect of producing castings far more perfect in character, being much freer from pinholes, etc., than when of iron.

The advantages which may be derived by the use of this refinery plant are summarized below and are quite independent of those further important ones, enumerated elsewhere, attending the adoption of the direct rolling process. The latter might be employed in conjunction with the plant or not, as may be expedient, or according to whether the raw refinery products are to be marketed as such, or are to be put through the next stage of being manufactured. In the latter case, then the importance of immediately rolling them direct must be obvious, as the hot cakes, etc., would be already turned out by this plant ready to hand. For roughing the products or semi-manufacturing them or even with the present methods of manufacturing, the use of the above plant alone in the refinery must prove highly advantageous.

Summary of Advantages.

1. Great reduction of time in emptying the refining furnace charge, through doing away with hand-ladling, as now practiced, for all the larger masses of refinery products by means of tapping from the furnace and pouring from a big ladle; at the same time enabling either of the above methods to be effected, as found desirable for any particular product. Less liability to variation of pitch in the copper in the bath and the consequent production of more uniform metal once it has been brought to proper condition.

2. Prevention of chilling and setting of the molten copper in the ladle, by a continuous flow of metal into same at a high

temperature direct from the furnace.

3. The amelioration to a great extent of the present trying conditions for the workmen in carrying out the tedious work now necessary.

4. Enabling all the operations to be performed by manual labor and obviating the installation of mechanical power and expensive and complicated appliances in the refinery, if not desirable.

5. Freedom and independence of movement of the bogie cars over other mechanical appliances by the provision of storage room for the cars between the various positions.

6. Enabling the furnace charge of cakes, etc., to be available on the same day instead of the next, as at present.

7. Prevention of cold sets, etc., through being able to pour in a much larger body and so filling the molds more rapidly.

8. Improved construction of the special molds, being all self-contained and thus doing away with the trouble of assembling the various parts before each cast and taking them apart again after same; also by the use of permanent copper bottom plates for same, favoring the production of sounder metal by the elimination of pinholes, etc.; and finally their tipping facilities for ejecting the hot cakes or bars and enabling generally the employment of direct rolling and its further advantages to be derived.

CASTING BRASS ON IRON.

Inquiry.—We should be extremely obliged if you would give us an answer to the following inquiry through the Brass Foundry Notes. We have tried casting a number of gun metal and also

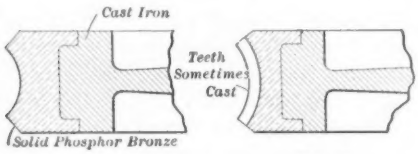


Fig. 1

Fig. 2

phosphor bronze rings around cast iron centers. We heat the centers to a dark red before pouring our bronze or gun metal around them. The castings are for worm wheels and vary greatly in diameter and thickness. Some times the teeth are cast in, but at other times the pieces are cast blank, but in all cases the teeth have to be finished by machine cutting. We have been sorely troubled by blow holes showing in the teeth when they are machined. A cross section of the gear is shown in the accompanying figures. Fig. 1 shows a cross section of the gear when cast blank and Fig. 2 when cast with the teeth in it.

Answer.—The wheels in question are

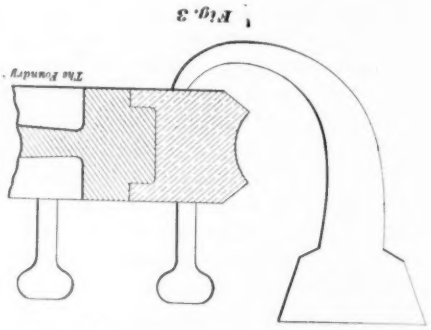


Fig. 3

for heavy gears and they would probably weigh from 60 to 100 pounds. Dry sand molds are essential for this class of work. The ordinary method of avoiding air holes in such castings is to flow a surplus of metal through the mold. It is thought that the gases rising from the heated iron are by this means carried away from the casting. With a sluggish fluid like gun metal this flushing of the mold is good practice, but with a highly fluid metal like phosphor bronze it would be positive extravagance. For this casting I would recommend a good old-fashioned horn gate (for the larger sizes two gates at opposite points, to be poured with two crucibles), with risers distributed on the cope at regular intervals, say 6 inches apart all around the circumference. Fig. 3 shows a cross section of the rim of the gear with a horn gate and riser.

The cast iron center should be of close grained iron and it would be a decided advantage to have it twice heated before being placed in the mold for casting. Perhaps the most important consideration in such castings is the temperature. The iron should not be raised above a dark cherry hue when

first heated. At the time of casting a black heat should be sufficient.

As regards the casting temperature of alloys, we have still to depend upon rule of thumb. I would not advocate hot metal for this job as some do, because the hotter the metal is made, the more active it is to form and absorb gases. The blow holes complained of are common to all the conditions of casting copper alloys upon iron and it is always possible to minimize them by conducting the gases freely from the mold. If the wheels are cast as directed and an additional machining allowance (3-16 of an inch) is given on the top side of the pattern, the trouble should cease.

J. F. BUCHANAN.

BRASS VALVES LEAKING.

Inquiry.—Can you please give us a formula for metal for brass valves that will be close and will not leak. This is a special valve that we are making. They are about 3 inches in diameter and under some circumstances have to stand a water pressure of 500 pounds per square inch.

Answer.—A formula that would answer the above requirements consists of

Copper	89%
Tin	5%
Lead	3%
Zinc	3%

This is a good mixture, both for casting and in general appearance of the finished valve. Care must be exercised in melting to avoid oxidation. In case the casting contained light and heavy parts, increase the tin to 6% or 7%.

W. M. CORSE.

WAYS OF WEARING A "WHITE SHIRT."

BY OSCAR W. BURNS.

They were going to cast a large flywheel at one of the foundries in our vicinity and a friend of mine invited me to go with him and see it done. He was a friend of the owner, who had told him about it, and so we were sure of getting in. About the time that we thought the wind should be on we went and found that the foundry was a very busy place, indeed. It was said that this was to be the largest casting that had been made in town. I thought a casting that weighed a ton was a large one, but this one would weigh several tons.

There was an air of excitement around that was quite noticeable, and the foundry boss was flying around shouting orders, and sending men on the run first in one direction and then in another. It looked a little as though he knew he had a big job on his hands and had slightly lost his nerve.

While we were standing to one side where we were not likely to get in the way of anyone, the owner came in and stood watching him. The activity of the foundry foreman was very noticeably increased. The metal was filling one ladle. There were two cupolas and the iron was ready to be taken from the second one. The ladle was much larger than the one usually used under it and to make room for it a hole had been dug in the floor. When the ladle was lowered into it it was found that the hole was not deep enough and the ladle was raised enough to enable the sand to be taken from under it. Several laborers stood around waiting for orders, but evidently they did not have the confidence of the boss, for he grabbed up a shovel and sprang into the hole and began to throw out the dirt at a rate that no man could keep up for long. It could not be expected from a laborer who was working by the day. All of the laborers in the vicinity stood and looked on. When the ladle was finally in place and the iron running in something seemed to be wrong up on the charging floor, for the boss had to make a flying trip up there. Then he had to get across to where some medium sized work was being poured. It was evident that the man who was filling ladles from the first big one did not understand his business, for the boss had to take hold and fill one for him.

When the iron was over, ready to go into the big mold there was a delay while the boss held an earnest and heated discussion with one of the men. I was too far away to know what it was about. Evidently it had to do with the mold in some way, for he waved his hands and

pointed to it as he talked. After much shouting the ladles were raised and the pouring proceeded, and in the meantime I got quite a ways off and where an open door was at hand. I am not entirely strange in a foundry, nor extraordinarily timid, but then—

I do not know why they checked the pouring while the boss did some rapid maneuvering, nor why the iron spluttered and spattered, and it did not seem like an opportune time to ask questions, so finally we came away.

I did hear that the casting was not as good as could be wished, but that they had hopes of being able to use it, as the engine was to be used by a concern of which the owner of the foundry was a large stockholder.

I came away, thinking of a story I had once heard. As I now think of it, it was something like this:

Bill was a good man, a good workman, and quite a capable fellow. He had worked in the shop for several years and was well acquainted with the work.

Several times when the foreman had been absent he had looked after things, and had done very well. Although he was a middle aged man he had never been a regular foreman. By some change the foreman had left and it was necessary to have another one, and for some reason the two men who owned the shop put Bill in charge. He was given to understand that he was to have a chance, and if he could fill the place in a satisfactory manner he was to be the permanent foreman. Of course, Bill worked hard and did his utmost to push things along and make a good showing. After he had been at it for several months he began to wonder how he was suiting. He was somewhat encouraged by the fact that he had not been told to get out, but also somewhat discouraged by the fact that he had not been told that he was suiting. Perhaps he wanted to know whether the increase of wages was to be permanent. At any rate, he concluded to have an interview with the members of the firm, and find out where he stood.

At a time when they were both in the office he went in and opened up. "Gentlemen, I have been foreman for quite a little time now. When I began it was with the understanding that if I suited I was to stay right on. I would like to know what you think of me. If there is anything that I can do that I am not doing to have things come better I hope you will let me know, for I am willing to do anything that I can to make it a go."

Mr. Smith, who was usually the spokesman of the firm, looked up with a smile. "Well, William, I think that you have been doing very well, and that we will keep you where you are. I don't think I have any suggestion to offer at this time."

Mr. Davis, who was the other member of the firm, did not say anything. Bill wondered how he felt about it. "How is it with you, Mr. Davis?" he asked.

"There is just one little thing that I have sometimes thought of. I have an idea that you should wear a white shirt in the shop."

Bill stared at Mr. Davis, and then down at his clothes. It may be that he had a vision of all the difference in wages going into clothes. "Why, Mr. Davis, I don't see how I could keep a white shirt looking decent in the shop. You see I take hold and give a hand first here and then there 'till by night I am likely to be the dirtiest man in the shop."

"May be you could not do it, but I have an idea that I would like to see you wearing a white shirt. We have a large shop and I have always thought that the foreman of it should wear a white shirt. Think it over."

Bill did think it over. He tried to imagine himself in a white shirt in the shop. Every time he started to take hold of some job he thought of it, and every time he started to get into some dirty hole he thought of it, and the more he thought of it the more he saw that if he tried to keep his shirt clean he would also have to try to educate the men to do the things that he had been trying to do himself. After a time a light seemed to break in on him. Could that be what Mr. Davis had been hinting at? After trying it a while he found that there was lots of work for him to do without soiling his shirt, and he could also see that it paid the company much better for him to give his attention to training his men to do the work properly than it did to have him

trying to do a man's work when, as likely as not, men were standing around not knowing what to do.

Perhaps the owner of that foundry was looking for a man who could wear a white shirt, for he got a new boss in a short time.

Tom was a laborer who was cleaning castings at a foundry. He was a good man at the job and seemed always willing to hurry anything through if he knew it was in a hurry. He was put in charge of the chipping gang of three men as gang boss, with a raise of a quarter a day. It was not long before he began to stand around smoking cigars and growling at the men, and if there was anything easy around to do he was the one to do it, and to take his own time at it.

He was spoken to very plainly once, but it seemed that with that raise had come the idea that the concern would have to go out of business if he did not hold them up, and he did not take the hint.

I do not know where he is at present.

CARPENTER DEPARTMENT HEADS DINED.

The heads of departments of the A. Carpenter & Sons' Foundry Co., Providence, R. I., were tendered their fourth annual dinner at the Narragansett Hotel, Jan. 1, Henry A. Carpenter, treasurer of the concern, acting as host. Louis F. Patterson, a former foreman now connected with the United Shoe Machinery Co., Beverly, Mass., was a special guest, the other diners being Henry A. Carpenter, Supt. H. C. Arnold, accountant O. C. Barrows, C. Harold Tholl, P. M. Waldron. F. O. Wilbur, W. D. Kent, Charles E. Allen, Graham Allerdice, H. A. McLellan, George F. Whipple, James O'Gara, J. C. Fillmore, Frank Rogers, Walter M. Saunders, Frank Bezanson, W. A. Short and Jesse B. Bicknell. The menu arranged for the occasion was a unique creation, each course, from the "Fluor Spar Oysters" to the "Cupola Stacks" having some special significance to the foundryman. The liquids were designated as "Molten Ferro," "Oil of Vitriol," "Strained Clay Wash," "Molasses Water," "Black Strap" and "Core Oil." When the "cupola stacks" were lighted, the following toasts were responded to: "How to Save Money," Henry A. Carpenter; "The Ladies," George F. Whipple; "System," O. C. Barrows; "Advantages of Machines," W. D. Kent; "How We Got a Million in 25 Days," D. G. B. Allerdice; "Be on Deck in the Morning," H. C. Arnold. Informal talks were made and Mr. Carpenter, on behalf of the foremen, presented Mr. Barrows with a handsome floral piece in the shape of a bull ladle.

TWENTY-FIFTH ANNIVERSARY.

During Dec. 13, 14 and 15 Rogers, Brown & Co. held in Cincinnati a meeting of the firm members, resident managers and other representatives to commemorate the twenty-fifth anniversary of the founding of the firm. It was by far the largest, most representative and enthusiastic gathering the company has ever held, and as it marks an epoch in the history of this leading pig iron house, it becomes an event of unusual interest.

The original firm, Rogers & Trivett, formed in November 1880 by Wm. A. Rogers and Robt. C. Trivett, is actually the beginning of Rogers, Brown & Co., Mr. Archer Brown becoming associated with Mr. Rogers a year later, after Mr. Trivett's death. The history of Rogers, Brown & Co. since that time is a record of constant growth and expansion which has been marked at intervals by the entering into the partnership of D. B. Meacham, M. C. Armour and W. C. Herron. Mr. Herron retired a few years ago because of loss of health. Mr. A. A. Fowler entered the firm in 1904, and a year ago, shortly after Mr. Brown's death, the present partnership was completed by E. L. Billingslea, W. T. Shepard and J. K. Pollock.

Dec. 13 the partners of the firm held their annual meeting, and on Thursday the resident managers and salesmen from out of town began to arrive. Thursday noon the company, number-

ing thirty, dined at the Queen City Club. The menu, being rather an unusual one, is given herewith:

Huitres, demi Limestone
Filets Salisbury, with fresh shot iron
72-hour crushed egg plant, hard blown
Oriskany potatoes a la silvery
Lettuce, cold blast
Furnace Scrap, Slag timbale
Fromages, high sulphur
Cafe maitre de foundry
Cigars

(Rogerique, Brownello et Cie)

During the course of the dinner and afterward, under Mr. D. B. Meacham as toastmaster, the following toasts were responded to:

Welcome.....D. B. Meacham.

"I charge thee, invite them all, let in the tide
Of braves once more; my cook and I'll provide."
Shakespeare.

Response.....C. A. Stillman.

"A curse begin at every root of his heart that is
Not glad to be here." Aristotle.

How to Increase Our Coke Business.....G. P. Bassett Jr.

"His years but young, but his experience old;
His head ungarnished, but his judgment ripe."
Pope.

Getting New Business.
.....J. C. Mears.

"Of all the horrid, hideous notes e'er taught,
Sadder than owl-songs or the midnight blast,
Is that portentous phrase, 'I have just bought'."
The Knight of the Grip.

How to Induce Buyers to Use Special Irons..Harwood Wilson.

"A persuasive tongue is more to be envied than great riches." The Koran.

Looking Backward Twenty-five Years.....W. A. Rogers.

"Lull'd in the countless chambers of the brain,
Our thoughts are linked by many a hidden chain,
Awake but one, and lo! what myriads rise!
Each stamps its image as the other flies."
Rogers: Pleasures of Memory.

Looking Forward Twenty-five Years.....A. A. Fowler.

"If you can look into the seeds of time
And say which grain will grow and which will not,
Speak then to me." Roosevelt.

Mr. Rogers' address was one of great interest to all present. He traced the beginning of the firm and its embarkation on the then unknown road which it has so successfully traveled, and described the earlier life and experiences of the young men who later associated themselves in the company. A note of sadness was occasioned by the absence of Mr. Brown, who, had he lived, would have been one of the leading spirits in the present reunion. Mr. Rogers made the occasion one for personal tribute to Mr. Brown, whose death occurred about a year ago, and with whom he had been associated so intimately since early manhood. He spoke out of the fulness of his heart as he traced the personal character and business attainments of his friend, and showed how the integrity and high character of Mr. Brown was always present in his home life and business dealings. For the benefit of the younger men present, he stated that no better example of business rectitude could be held before them in the performance of their duties with the company and elsewhere during their life. He dwelt especially on the character of the firm as it has been molded by Mr. Brown, and paid a tribute to him when stating that the company's present high regard in the business world was the direct result of this influence by him and on his associates. Mr. Rogers's talk was an inspiration to all present, and while many of the recollections which the meeting doubtless brought back to Mr. Rogers may have been sad ones, it was fitting that the qualities which have so long marked the firm of Rogers, Brown & Co., should be commented upon and one of their strongest upholders honored.

Thursday evening Mr. Meacham entertained the company at his home in Avondale. The meeting was for mutual exchange of ideas and was a most informal and delightful gathering. The Rogers, Brown & Co. Glee Club, formed on the spot, rendered many choice selections.

On Friday the visitors were entertained at luncheon at the Business Men's Club, when there was a further and informal discussion of plans and methods for the following year. Friday afternoon saw the departure of a number of the party and the end of the meeting, which had been not only a benefit in a business way but also a source of pleasure and new acquaintances on the part of all. Those present during the three days were the following: W. A. Rogers, D. B. Meacham, M. C. Armour, A. A. Fowler, W. T. Shepard, E. L. Billingslea, J. K. Pollock, Robert

Gilchrist, G. R. Sullivan, S. W. Hubbard, Harwood Wilson, G. P. Bassett Jr., Jas. R. Darragh, H. W. Fernald, J. C. Mears, F. W. Bauer, C. A Stillman, F. I. Foote, F. C. Wright, H. E. Frazier, E. McBirney, H. E. Turner, W. D. Patton, F. W. Miller, Geo. W. Douglas, A. J. Wentworth, H. B. B. Yergason, R. D. Meacham, W. P. Hanson and Phillips Isham.

Mr. C. H. Zehnder, resident manager in Philadelphia, was the only absentee, being kept in the east on account of important business engagements which it was impossible to change.

ASSOCIATIONS AND SOCIETIES.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The annual meeting and observance of the tenth anniversary of the New England Foundrymen's Association was held at the Exchange Club, Boston, Wednesday, Jan. 10, at 4:30 p. m. The routine business was disposed of in the usual manner, President John Magee in the chair. The secretary reported a total membership of 118 concerns and two honorary members. The treasurer reported a large balance on hand and all bills paid. The election of officers resulted as follows: President, Walter B. Snow, B. F. Sturtevant & Co.; vice president, Wm. H. Bense, Kinsley Iron & Machine Co.; treasurer, George H. Lincoln, G. H. Lincoln & Co.; secretary, F. F. Stockwell, Barbour-Stockwell Co.

For an executive committee of five, the following were elected: H. A. Carpenter, A. Carpenter & Sons Foundry Co.; H. F. Arnold, American Tool & Machine Co.; Chas. J. Caley, Russell & Erwin Mfg. Co.; Aruthur Gibby, Mechanics' Iron Foundry; H. E. Wetherbee, Jas. Hunter Machine Co.

The new president, Mr. Snow, thanked the members in a very pleasing manner for the honor bestowed.

Report was received of the death of Mr. M. J. Dyer, Valley Falls, R. I., and Messrs. Nicholson, Carpenter and Miller were appointed a committee to prepare resolutions.

After dinner Pres. Snow introduced Mr. Henry A. Carpenter, former president, who acted as toastmaster in his usual most acceptable manner and was particularly happy in the choice of his numerous quotations and sallies. He also congratulated the organization on its growth, declaring it to be the pioneer of local foundrymen's associations in this country and responsible for the formation of the national body.

Hon. Eugene N. Foss, of Boston, the principal guest and speaker, delivered an address on "Reciprocity," at the conclusion of which President Snow spoke of the association's prosperity and urged renewed efforts on the part of the members to accomplish a wider growth.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The fifteenth annual meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' club in that city on the evening of Jan. 3, when the following officers were elected: President, Thomas Devlin, of the Thomas Devlin Manufacturing Co.; vice president Alex. E. Outerbridge Jr., of Wm. Sellers & Co.; treasurer, Josiah Thompson, of J. Thompson & Co.; secretary, Howard Evans, of J. W. Paxson & Co.,; executive committee, H. O. Evans, Thomas M. Eynon, E. E. Brown, R. C. Oliphant, George C. Davis; trustees, Thomas Devlin, Josiah Thompson, Howard Evans; official chemist Geo. C. Davis. In the absence of President Devlin, who, with many other members, was prevented from attending by a heavy storm, Dr. E. E. Brown presided, and Secretary Evans read a brief summary of the association's fifteen years. Organized on July 29, 1891 the association was the pioneer body of its kind in the foundry trade, and its success has led to the formation of similar organizations in other parts of the country and the American Foundrymen's Association and National Foundry Association. It now has about 100 members and is in a flourishing financial condition, with $1,800 in the treasury. It is worth noting that

the present treasurer and secretary Messrs. Thompson and Evans, have held those positions continuously since the formation of the association. The officers were given a formal vote of thanks by the association for their excellent work.

An interesting paper on "Permanent Molds and Carbon Cores," prepared by Henry C. Caldwell, of the Combination Foundry Co., Buffalo, N. Y., was read by J. W. Daniels, who showed a number of sample castings to illustrate the results secured by Mr. Caldwell. In a brief discussion which followed, the opinion seemed to be pretty general that the process was hardly feasible for large castings. Announcement was made by Mr. Daniels that a Delaware charter had been obtained that very day for the Caldwell Process Foundry Co., with a capital of $500,000, whose officers are: President, Franklin L. Sheppard, of the Isaac A. Sheppard Stove Co.; secretary, J. W. Daniels. Temporarily a portion of the foundry of the Sheppard Stove Co. in Philadelphia will be used, and arrangements are already so far advanced that the new company expects to be turning out castings by Feb. 1.

Permanent Molds.

Mr. Caldwell's paper was as follows:

The chill mold in which car wheels are cast is a success; that we concede, but inasmuch as it can be applied to no other work it is not very interesting to foundrymen in general.

The reason metal molds have not been practical except for very low melting point metals is because unequal expansion rapidly destroys the mold if it is thick enough to prevent warping. The hot metal will expand the inner portion of the mold very much more than the radiating heat will expand the outer portion.

It has not been hard for experimenters to conclude that carbon was the logical thing from which permanent molds should be made. This was because they had better results than with any other substance.

Several inventors were so successful in their experiments that they secured patents on "carbon molds"—two of them so long ago that their patents have expired by time limit.

Experiments are apt to be made with lead or aluminum and so many duplicates produced from one mold that the inventor concludes that he has solved the problem only to find that when he pours gray iron or brass his mold ignites or gradually disintegrates from expansion and contraction, and that his only advantage over a metal mold is his low cost of production.

Like many others, the writer concluded, after carefully looking the ground over, that carbon was the only substance from which a permanent mold, in the sense we have in mind, would ever be made. He then began to study the problem and to repeat to himself the question, why is it that theoretically we can make permanent molds out of carbon but practically we cannot?

Having long since become a convert to the theory that all elements have their ignition point and that the only difference between any two things is the difference in temperature at which they are created or the speed and direction in which they are going, I began to reason like this: Carbon will ignite in contact with oxygen when the temperature arrives at the right point, and the right point varies according to the kind of carbon and the kinds of carbon vary according to the temperature at which they are produced.

For illustration take ordinary bituminous coal, place it in a retort and submit it to a temperature of 212 deg. F. and you will drive off steam but you will not affect the other constituent parts. Raise the temperature and drive off a certain amount of volatile matter or gas and you will have left a piece of ordinary coke. This piece of coke will ignite if it comes in contact with molten metal provided the melting point of the metal is higher than the highest temperature to which the coke was submitted. Suppose, however, you had continued to raise the temperature of your retort until you had carried it beyond the melting point of steel, for

instance; then, the point of ignition of the carbon would be above the temperature of molten metal, and, as a consequence, it would not ignite when the metal was poured against it.

In order to test the theory, suppose, you take a quantity of very fine, dry sawdust and apply a match to it. The result will be instantaneous ignition. Take the same quantity of the same kind of sawdust and subject it to a very high pressure, sufficient to reduce its bulk to one tenth its original size, and see how much longer it will take you to ignite it. The pressure does the same thing in a modified way to the sawdust as the high temperature does to the coke, because temperature and pressure are really the same thing.

Theoretically, then the permanent mold problem was solved. All I had to do was to get some carbon (coke) produced at a higher temperature than the metal I intended to cast.

I secured a quantity of the hardest coke I could find and made some molds. I could pour aluminum castings indefinitely but when I tried brass I soon destroyed the mold.

My next move was to subject the mold to a very high baking heat with a view to raising the ignition point. In this I was reasonably successful; that is to say, I raised the point of ignition high enough to permit brass castings to be made but I had changed the shape of the mold so that the castings were not like the pattern. This was due to two causes: First, the surfaces of the molds, both inside and out, were disturbed by the gas as this temperature which was higher than that at which the coke was produced drove off; and, Second, because in baking the mold the temperature of the oven was uneven, being hotter on the bottom than it was on the top, which resulted in the bottom expanding before the top and causing a number of small cracks which so weakened the mold that it soon went to pieces.

By this time I came to the conclusion that the coke would have to be produced in the first place at a temperature high enough to drive out all of the volatile matter that would come out at say 4,000 degrees F. Having been a student of temperature for many years, and having, as I believe, succeeded in producing a fire many degrees hotter than is considered possible by many recognized authorities on chemical combustion, I began to look for a method of applying my knowledge to the manufacture of coke. This was not very difficult and in a short time I had what I was looking for, and again proceeded to make molds.

I found even this did not overcome all my troubles. It was still necessary to bake molds and it had to be done at a temperature so far above the melting point of the metal, that the limit, 4,200 degrees F. claimed by most scientists as the height of temperature possible by chemical combustion, would have to be very much exceeded.

I wanted an oven with a temperature absolutely uniform and even in every part, top, bottom, sides and center and I wanted that temperature to be over 4,200 degrees F. You can readily understand that if my oven was to attain this temperature throughout I would have a temperature far above this outside the oven. It took many weary days and nights to work this out. In fact, it ran into months and finally into years, but I succeeded; otherwise, I would not be here to-night.

Students and thinkers have latterly concluded that the only limit to temperature by chemical combustion is the means of controlling or rather containing it.

Molds baked in a 4,000 degree oven will withstand any molten metal up to and including steel. They will not expand or contract and seem to get better the longer they are used. If any of my hearers are skeptical they may test me out, and to this end I will launch a challenge at the risk of being convicted on the charge of boasting: I defy any of you to bring me a refractory substance, such as carbon points for arc lights, carborundum from the electrical furnaces at Niagara, or pieces of crucibles that I cannot reduce in fifteen minutes. I would like to be in a position to demonstrate this whole

matter to you all but we are not yet through with the Patent Office, and until we are, self preservation demands that we do not reveal our system or the construction of our furnaces except to the persons interested as stockholders in our company. Personally it is my desire, and I think my duty to give the results of my years of study to the world at large, demanding as a reward three meals a day and a place to sleep, but I am not in so fortunate a position because three meals a day and a place to sleep have been advanced to me by friends who had confidence in me and the ultimate results and, further, because it will cost a good many dollars to make the world at large believe that I have done what is here claimed and that I can do it again on a larger scale.

I think I hear some of you asking how I am going to take care of the shrinkage of the castings. It will surprise you to learn how many castings that at first seem incapable of being produced in permanent molds can be very readily handled.

Franklin L. Sheppard, whom most of you know and whom all of you have heard of, will be the first president of the company we are about to form. His business is manufacturing stoves, a field that on first thought one would think it very dangerous to enter. As a matter of fact we have figured out how it will be possible to make almost every part either in a permanent mold or parts of permanent molds. The rings, for instance, will be made in molds the outsides of which will be permanent and the centers sand to take care of the contraction which is all inward, and the molding machine will need a big handicap to beat us out.

The only question open is, how much carbon will be taken up by a steel casting?

My own opinion is that not enough will be taken up to change the analysis for the reason that the mold will not give up anything if you keep below the temperature in which it was baked. A number of steel experts agree with me on this point and none dispute me. My experiments have been very limited with steel because by the time I get up to and include gray iron I am in a field so wide that I do not expect to feel cramped.

A step in advance often makes it necessary, or at least advisable, to take another. It was only a short step but nevertheless a very important one from the carbon mold to the carbon core, and then another one to the carbon core box.

Core boxes are made exactly the same way and out of the same material that we make permanent molds. It is only necessary to have a core made in the usual way or a pattern such as you would have to make a casting, then make the box in sections, put the sections together, hold the box under a hopper containing an absolutely dry powder, fill the cavity, shake it down a little and place the whole thing in an oven with about a fifteen hundred degree temperature and in from five to thirty minutes, depending on size, the core is ready to take out of the box and as soon as it is cools enough to be handled it is ready for use. This will, as a matter of course, be much more valuable for intricate than plain work. By this system one is no more difficult than the other, but plain shapes are now made very cheap by the old process. Another great advantage is that a boy or a girl strong enough to lift the box can make a core as good as the most skillful core maker. Venting is practically done away with as the red heat to which they are submitted drives out all the gas that was in the carbon and leaves the core so porous that it will easily take up all the gases that may be in the metal.

These cores may be kept indefinitely and when we are through with them we grind them up and use the powder over again, or put them in our fire where they are worth almost as much for fuel as they cost to make originally. This material is much cheaper than any core compound I know of.

I did not select the proper binder for this powder the first time trying and my advice to you is not to wear out any gray matter in an effort to learn

what it is. I was standing on my head when I thought of trying it and as very few of you would care to remain long in that position, just bide your time for a few months and I will tell you all about it.

I have a very rapid process for making copper patterns, a thousand of which can be made and they won't vary a 64th of an inch. Also a dry sand process that made possible the small cylinder shown you, and by which I have been doing some very interesting stunts in multiple molding, but as they are really foreign to the subject of the evening we will not go into their field.

This paper is submitted against my judgment, but at the earnest solicitation of a number of my friends who seem to feel that because I am about to move from Buffalo, N. Y. to Philadelphia, I should embrace the first opportunity of getting acquainted with the foundrymen in this vicinity.

I do not agree with my friends on this point and I am going to tell you the reason frankly at the risk of hurting some of your feelings. History says, and my own experience has taught me, that most new discoveries that are revolutionary are nursed in their infancy and matured by people entirely outside of the line of business to which they will apply if successful.

Cleveland Foundry Foremen.

H M. Lane, Browning Bldg. Secretary.

The January meeting of the Cleveland Foundry Foremen was held on Saturday evening, Jan. 6. The meeting was devoted to the discussion of plans for the ensuing year, including the convention of the A. F. F., which is to meet in Cleveland this year. The officers for the ensuing year are: Hugh Mackenzie, American Ship Building Co., president, Chas. Olsen, Johnston & Jennings Foundry Co., first vice president; John Lewis, foundry superintendent of the Westinghouse Electric & Mfg. Co., second vice president; H. M. Lane, secretary and treasurer.

The plans of the club for the ensuing year include a number of meetings at which interesting papers will be presented, or discussions take place, and this, together with the preparation for the coming convention, will certainly insure an active and profitable winter and spring.

Philadelphia Foundry Foremen.

W. P. Cunningham, American Bridge Co. Sec'y.

The regular meeting of the Philadelphia Foundry Foremen's association was held January 8. After the transaction of the regular business and the election of three new members, a very interesting paper was presented by Mr. C. Caldwell, on permanent molds and carbon cores. The paper resulted in extensive discussion. After the discussion of the paper, a light lunch was served for the members.

Montreal Foundry Foremen.

Mr. J. F. Gaffney, care of Allis-Chalmers Bullock Co.

All of the readers of THE FOUNDRY will be interested to know that local No. 10 of the A. F. F. was formed at Montreal, Canada, on Saturday, December 30, and a strong local association is now ready for the new year's work.

Several of the men have been corresponding with President David Reid of the Canada Westinghouse Company, Hamilton, Canada, for some time, and it was finally arranged for him to go to Montreal, and meet those interested in forming a local association, if it was deemed best. Two preliminary meetings were held in Mr. Weaver's office, previous to the one mentioned, and 20 names were secured to start the association. Mr. Reid then left Hamilton on Friday night, and spent Saturday in Montreal, as a guest of the local foremen.

In the evening a special meeting was called in the parlors of the La Carona Hotel. Twenty foremen and superintendents were present. Mr. Rountree acted as chairman. All listened to the address given by Mr. Reid, setting forth the benefits of the A. F. F. A great many questions were asked by some of those present, the main fear being that this organization was simply a catspaw in the hands of the N. F. A.

to fight the I. M. U. of N. A. In answer to these inquiries, Mr. Reid read the constitution, that states distinctly that the object of the association shall be solely educational. Mr. Reid placed himself on record to resist all attempts of any organization to use the A. F. F. as a weapon in any kind of labor trouble; hence, the Montreal local has been organized on purely educational lines, as should be the case in all branches of the A. F. F.

After the meeting adjourned, those present went to the banquet room, where they did justice to a good supper. Toasts were next in order; the first toast of the evening was, of course, "The King," the second being "Theodore Roosevelt." Everyone present had a toast to respond to, and judging by the enthusiasm that prevailed, the Montreal branch has a bright future.

The new officers of the association are:

Mr. J. B. Rountree, the Locomotive Machine Company, President; Mr. Essery, Warden, King & Company, Vice President and Mr. J. F. Gaffney, The Allis-Chalmers Bullock Company, Ltd., Secretary and Treasurer.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

F. H. Zimmers, Secretary, Care Union Foundry and Machine Co., West Carson Street.

NEWARK FOUNDRYMEN'S ASSOCIATION.

H. L. Gebhard, Secretary, 36 Francis St.

BUFFALO FOUNDRYMEN'S ASSOCIATION.

John E. Gross, Secretary, 23 Builders' Exchange.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, care the J. L. Mott Iron Works, Trenton, N. J., Secretary.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.

C. H. Thomas, 14 Elizabeth St., So. Norwalk, Conn., District Vice President.

ERIE FOUNDRY FOREMEN.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

CHICAGO FOUNDRY FOREMEN.

Mr. Thompson, Link Belt Co., District Vice Pres

MILWAUKEE FOUNDRY FOREMEN.

Sol. Shaw, care Clinton Street Foundry of Allis-Chalmers Co., Secretary.

CINCINNATI FOUNDRY FOREMEN.

E. W. Cadwell, Secretary, care S. C. Tatum Co.

INDIANAPOLIS FOUNDRY FOREMEN.

W. S. Keller, of Hetherington & Berner Co., District Vice President.

HAMILTON, ONT., FOUNDRY FOREMEN'S ASSOCIATION.

A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

BOOK REVIEW.

Traite pratique de la Fonderie de Fer. By G. Vander Haegben, foundry superintendent, and L. Ledent, master molder. Published by Desoer, Liege, Belgium. The third edition of a work on the founding of gray iron, well known in France and Belgium.

Following European methods a very thorough description of methods of tempering sand by machinery is given, in this they are somewhat ahead of our American practice. Hand tempering of sand is not gone into as it should be, possibly that is considered as self-evident. In mixing up blacking there is described an interesting method in use in most of the Belgium foundries, and which will interest our facing men. Charcoal is pulverized very finely and mixed with some plastic clay to make it bind. It is then mixed up with a liquid resulting from the fermented urine of all the workmen of the place, which is collected and stored up for that purpose. Graphite is added, and the result is said to make most excellent surfaces on the castings. Next comes an elementary treatise on molding methods, special attention being given to the use of sweeps, molding gears by machinery, drying molds, etc. The description is simple and easily understood.

Core making follows, then loam molding with the several pouring methods to get good results. The bedding of molds is gone into, with general hints on management of the men.

Several types of cupolas are shown and explained. We see the to us unfamiliar fore-hearth cupola, which

should be studied here more for what it is worth. Fans and blowers. A chapter on patternmaking, the weighing of patterns for obtaining the weight of the castings they make, and finally the design of the buildings, complete the first section of the book, written by the master molder. It must be said that while the descriptions are all right in their way, the book is exceedingly elementary. Comparing it with that of Mr. West on the same subject, one is surprised to see so little attention given to thoroughness and detail on the part of the French work. One is tempted to think that most of the "secrets" of the business are purposely left out.

The second part of the book, written from moderate data, is therefore all the more welcome, as it is an amplification of what went on before. Many points are discussed, and the transactions of the American Foundrymen's Association freely drawn upon. Credit is duly given for American ideas. The discussion of the molding machine is thorough, and on the lines of Mr. Stupakoff's able work. Short chapters on crystallization, skin drying, contraction, core molding machines, foundry mixtures, and a number of other good and important points complete the book. A very good couple of pages on first aid in case of accident by burning or asphyxiation must not be forgotten.

Summing up:—The work is a good one for general foundry reading, but does not go into the subject matter thoroughly enough to make it a guide and friend to the molder as our more advanced American books certainly are. The illustrations are very poor, and should be redrawn and their number greatly increased. If the second part of the book were incorporated directly into the first portion, the number of pages thus cut out could be utilized in getting out a better work as a whole. Still, as representing European foundry practice, the book is interesting.

TRADE PUBLICATIONS.

The Ingersoll Rand Co., of New York City, has issued a little catalogue 5¾ x 3½ inches entitled "Compressed Air Displacement Pumps," in which it describes this type of pump which may be used in any case where compressed air is available. There are undoubtedly many cases in foundry practice in which pumps of this type would be found very advantageous.

The B. F. Sturtevant Company, Hyde Park, Mass., have issued the second number of their new series of bulletins, which is entitled "Bulletin No. 126," and deals with gas boosters. These are special types of fans, developed for increasing the pressure in gas mains, and are useful where gas at slightly increased pressure is required in any metallurgical operations in connection with furnaces or other heating devices. They are also useful for increasing the pressure in gas mains, so as to force an increased volume through great lengths of pipe, or in places where, owing to some conditions, the pressure is not sufficient for the purposes to which the gas is applied.

The Chrome Steel Works, of Chrome, N. J., is sending out a calendar composed of a long panel having a gold tint and in the upper portion a bust figure of a woman. In the lower portion is a calendar having a leaf for each month, the figures being ¾ of an inch high.

The J. D. Smith Foundry Supply Co., of Cleveland, O., is sending out a calendar called "The Plumbago Girl," but plumbago does not seem to have been used anywhere unless it was in her hair, for that is the only black thing about the picture. It is a very neatly gotten up calendar, with the picture of a girl dressed in the latest style, with a big bunch of violets for a bouquet.

The Colonial Fdy. & Machine Co., South Norwalk, Conn., is sending out a casting of an eagle with a shield before it, upon which is lettered "The Colonial Foundry & Machine Co., South Norwalk, Conn." At the bottom of the casting is attached by paper fasteners a calendar for 1906. The casting is a good sharp gray iron casting, showing good workmanship, and the calendar is large enough to be seen some distance.

DULL IRON.

Question.—We are experiencing some trouble with our coke, which is not the genuine 72-hour grade. The bed becomes dead shortly after the first tap, we have to wait too long for the next tap, and then the iron is almost too dull to pour.

Answer.—You are not starting your fire early enough. Start the fire two full hours before you are to tap the first iron. A great deal of cupola trouble comes from the cupola being too cold when the blast is put on. All wood should be burned out and a solid bed of red coke should extend from the sand bottom to about 15 inches above the tuyeres.

HEAT OF OVENS.

Question.—What is the correct heat of core ovens and of ordinary stove baking ovens?

Answer.—An oven doing good work on light cores should be about 400 degrees. Good work on very light cores can be done with a steam heat, say about 250 degrees, but a core an inch thick would not be baked thoroughly in the center.

A gas stove oven can be brought to 500 degrees in about 5 minutes, and then if one burner is turned off the temperature will still rise a few degrees but bread will bake in this temperature in a satisfactory manner. In a coal range even at 350 degrees bread will bake, but it takes a little longer.

STEEL CASTING NOTES.

FACING SAND FOR STEEL CASTINGS.

Inquiry: One of our subscribers in New Zealand writes as follows:

Concerning sand for steel castings, I beg leave to ask you to publish the composition or ingredients of facing sand, suitable for steel castings. The sand we have here is of a very low, refractory nature, so that we consider that it would be necessary to use a large percentage of ground fire brick. My own idea is that 50 per cent fire clay, 25 per cent builders' sand and 25 per cent ground fire brick, would be a proper mixture. I am commencing operations on a small steel foundry in this town, and would like to know of a facing sand mixture and also a blackwash used for medium size steel castings.

Answer: The mixture necessary for steel casting facing sand varies with local conditions. To get the best results with a good refractory sand available on green sand work, it is recommended that new sand be used for facing material, and that it be bonded with good fire clay, and in the proportion of one part of clay to 10 parts of sand. This mixture should then be tempered with molasses water, containing one part of molasses to 20 parts of water. For backing the mold, old or burnt sand may be used. Green sand molds are not washed, but are dusted with silica ground to an impalpable powder.

For dry sand work, the facing with a good sand should consist of sand and fire clay mixed in the proportions of 6 parts of sand to 1 part of fire clay, the mixture being tempered with molasses water, as before mentioned. The mold should then be painted or dusted with silica finely ground, which should be mixed with molasses water of the same strength as we described. Castings poured in such molds, ought to strip nicely, provided the sand is refractory.

Some foundries, to economize, use heap or burnt sand mixed with new sand as a facing, but the castings are apt to be rough. Almost every foundry has its own mixture, and no general rule can be laid down, but with a few trials along the lines suggested, no difficulty should be experienced in getting the proper mixture.

W. M. CARR.

The American Steam Pump Co., of Battle Creek, Mich., successors to the Battle Creek Steam Pump Co., is sending out a very neat little calendar upon a card 8 x 10 inches. The upper half of the card is taken up with a picture of the company's works and some advertising matter and the lower half is taken up with a calendar for 1906, all of the months being on one page. It is especially useful for desk work.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Malleable Iron and Steel.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

We have also made arrangements with several others to act as special contributors. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

CASTING BOTTLE MOLDS ON CHILLS.

Question.—I am casting a lot of bottle molds for flint glass bottles.

I use No. 1 northern and No. 1 southern iron with heavy railroad scrap, which I pour at the last of the heat to be certain that the iron is white hot.

The castings for the molds are made with chills to make the iron close grained but soft enough to allow the surface to be turned and finished.

The chills are from ½ inch to ¾ inch thick for a mold that would weigh about 75 pounds.

I paint the chills with turpentine and lampblack to prevent the iron from sticking.

My troubles are that the iron is a little hard. It will not lay on the chills and the surface has scabs and small blowholes and there are small circles enclosing a globule of iron as large as a pea which falls out when the surface is cut. It appears like shot iron.

Answer.—To soften the mixture, either leave out the railroad scrap or else use a silvery iron. In either way you can make the casting as soft as you wish.

To get a solid mold you should have very soft and fluid iron.

To get a close grain, use plenty of scrap, but I would recommend light instead of heavy scrap and soften with silvery iron.

If your molds are sound and cut away by the heat of the glass you may be obliged to use less scrap and more pig iron, for the reason that scrap contains more sulphur than pig iron. Sulphur will cause the surface of a mold to become rough.

You should coat the chills very slightly with ordinary machine oil. Use a cloth with very little on so as to get very little on the chill. If you get too much oil on it will make gas and flame in the mold and will make steam.

You should be sure that your chill is not cold and that it is perfectly dry when it is put in the mold. Do not heat the chill, because it will make steam in the mold, which will deposit on the chill and cause trouble.

You may be obliged to dry the molds to prevent moisture condensing on the chill.

If you pour your molds with gates on each side and let the iron meet after passing around the chill it will be likely to cold-shut; better pour from one gate and get the iron in the mold as quick as you can. It would appear that you hesitated in pouring and let the iron splash on some of the parts of the mold.

The little particles of iron will not be likely to melt again, but will appear as pea shaped and will be surrounded by the iron that was poured later.

While it is better not to use the first ladle of iron for such work, it is better to pour it at the first rather than at the last of the heat.

COATING TO RESIST RUST.

Question.—In an iron casting that is exposed to running water and is nickel plated, what treatment will prevent rust.

Answer.—None. A zinc coating or ordinary galvanizing prevents rust because the zinc oxidizes more easily than iron and absorbs the oxygen and for a while protects the iron. Japan baked on is the best. If the castings could be heavily copper plated and burnished before nickel plating, they would not rust, but buffing before nickel would do no good. Any electro plating leaves minute holes through the plate through which moisture reaches the iron. Burnishing rubs the ductile copper across these holes and makes a complete covering. Nickel is not ductile and cannot be burnished.

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TRADE OUTLOOK.

The trade outlook for February is certainly good, for the month opens with the foundries exceedingly busy. The very open winter weather has enabled most of them to get in their winter supply of coke and iron and has relieved the congestion along these lines greatly. The Chicago pig iron market has for some time been in a peculiar position, as prices in Chicago were higher than those at other points, owing to the fact that the local plants were sold out for a long way ahead and it was necessary to move iron to Chicago from districts which rarely supply a product for this region. For instance, Southern iron has been sold in Chicago on a basis of $14.50 Birmingham, while in other districts it has been selling on a basis of $14.00 Birmingham for No. 2 foundry. This difference, however, is beginning to disappear and Southern iron has now been sold in Chicago on a basis of $14.00 Birmingham for No. 2 foundry and it is probable that the critical point in the market is past, so that Chicago manufactories will no longer be handicapped by having to pay a higher price for their iron.

An inquiry for a large tonnage from the leading cast iron pipe interest has brought very active competition in the Cleveland district and a quotation of $17 was made on No. 3 foundry. The buyer, however, decided to contract for only a small tonnage and await further developments.

No very large orders for foundry iron have been placed during the past month, though the total business is considerable. First, viewing the pig iron situation in general, it is of interest to note that the United States Steel Corporation has purchased a large tonnage of Bessemer pig iron for first quarter delivery for 1906, at $17.25, Valley furnaces. This leaves only small lots available and the ruling price is now $17.75 for Bessemer iron at valley furnaces. The report comes from Pittsburg that many of the agencies for Southern iron have been instructed to supply old customers, but not to seek new trade. With March 1 a new railroad rate on Southern iron will go into effect which will increase the freight

to points north of the Ohio river by 25 cents per ton and will be an additional handicap on the Southern producers.

It is interesting to note that at the beginning of 1904 pig iron was being produced at the rate of 10,000,000 tons per year. In January, 1905, the production was at the rate of 19,000,000 per year, and at the present rate is about 24,000,000 tons per year. In some sections the production is now fully equal to the demand, but owing to the fact that some of the blast furnaces must be blown out for repairs there is no danger of an excess production at present. Probably the most noticeable change in the foundry situation during the past year has been the great increase in the production of steel castings brought about both through the enlargement of existing steel foundries and through the construction of new plants. The manufacturers of the country seem to be able to take care of all this increased production without affecting the gray iron or malleable production seriously.

Another tendency that is interesting to note is the large number of firms that are arranging to produce two or more classes of castings for their own use or for their customers' use, so as to enable them to fill contracts without subletting a portion of them. The firms that have been supplying the railroads are finding it necessary to furnish both malleable and steel castings and many of them have made preparations to produce both classes. In like manner in some cases preparations have been made to produce gray iron castings also.

TRANSFER OF STANDARDIZATION WORK.

The readers of THE FOUNDRY will remember that some years ago the American Foundrymen's Association adopted a series of standardized drillings of cast iron as a guide for chemists making determinations in connection with foundry practice. This work was first proposed by Thomas D. West, who is now president of the American Foundrymen's Association and who has devoted a great deal of time and attention to it, so that to Mr. West and Prof. Smith, of the Case School of Applied Science, belongs the honor of developing this standard until it has become recognized throughout the world.

The United States Government standardization bureau has now decided to take over this matter and in the future they will furnish the drillings to those desiring them. The stock on hand and the entire matter has been purchased from the American Foundrymen's Association by the Government.

Director Stratton, of the Government Bureau of Standards, informs us that all orders for the drillings should be sent to the "Bureau of Standards," Washington, D. C. To avoid delay the remittance at the rate of $2.00 per sample of 150 grammes, or three samples of 150 grammes each for $5.00, should accompany the order and this may be in the form of a check or post office order made payable to the Bureau of Standards.

THE STEEL CASTING INDUSTRY GROWING.

The Bessemer pig iron market lately has drawn attention to the growth of the steel casting industry. The producers of steel ingots are, generally speaking, manufacturers of pig iron, and buy a comparatively small part of the pig iron they consume. The steel casting works, on the other hand, buy all the pig iron they use. They have been heavy purchasers of Bessemer pig iron in the past few weeks and have constituted an important factor in this market. As the production of basic open-hearth castings is relatively small, Bessemer is by far the chief grade of pig iron purchased for the manufacture of steel castings.

It being the present purpose merely to draw attention to the rate at which the production of steel castings is growing, it is unnecessary to refer to the advantages of the steel casting over the gray iron casting. Suffice it to remark that for many purposes, and particularly for railroad rolling stock, the steel casting has come into great favor. Something might also be said of the growth of the malleable casting industry, which uses a variety of Bessemer pig, but that also is foreign to the present purpose.

A recent summary, more or less complete and of course entirely trust-

worthy, presented by the American Iron and Steel Association enumerates no less than 11 steel casting plants which have been completed since June 1, 1904, to which date the association's last directory was carried. A further list of erection in progress in December, 1905, enumerated no less than seven steel casting plants. In both cases these figures refer only to plants to use the pneumatic or open-hearth process. There has been new construction on a number of plants to use the crucible process, but on account of the relatively small tonnage of such plants it is not well to disturb the general figures by including them.

An interesting feature developed by the data referred to is that whereas the steel casting plants completed between June 1, 1904, and Dec. 1, 1905, involved six converters of various patterns and nine open-hearth furnaces, the new construction now in progress involves eight converters and but one open-hearth furnace. This presentation is, of course, not conclusive as to the relative favor in which the two general processes now stand, but it is indicative. One reason for the diversion is that while the open-hearth furnace has for years been an accomplished fact, susceptible of comparatively little modification or improvement as regards the production of steel castings, the Bessemer converter, or rather the general pneumatic process, has been much studied and a number of new types or variations have been brought forth. Another reason is that, as the steel casting encroaches further upon the field of the gray iron casting, the demand grows for a relatively cheaper product which while not altogether as good as the finest casting possible with the open-hearth process, is yet greatly superior to the iron casting. The converter promises tonnage, and indeed its introduction has been somewhat delayed by the timidity of manufacturers who in some cases have shrunk from the tonnages they would have to market if they operated a converter with regularity. One of the claims put forth for a new converter is frequently the smallness of the tonnage on which it can be economically operated.

The effort to adapt the Bessemer or pneumatic process to the production of small tonnages, as for castings, is by no means a new one. It is rather that only in late years have the efforts been particularly successful. The old Clapp-Griffiths or stationary converter was once in considerable favor, but late in the eighties it began to retrograde, and is now scarcely heard of. About 1887 the Robert-Bessemer process was introduced from France, and met with such a cordial reception that by November, 1889, there were seven Robert-Bessemer plants completed in the United States, with a total of 11 converters, and one plant was being built, to contain three converters, making a total of eight plants with 14 converters. The American Iron and Steel Association's directory of June, 1904, showed but two Robert-Bessemer plants, while it showed 17 other special Bessemer plants, with 25 converters, and since then there have been completed, or commenced, 11 plants, with 14 converters, of various types.

Statistics of steel casting production in 1905 are not yet available. The increase over any previous year will doubtless be found to have been very large, and production in the current year is destined to show a further large increase. Steel castings being used so largely for railroad work, the production naturally shows rather erratic variations. There was a slump of almost a fourth in production from 1903 to 1904. The statistics from 1898, the first year for which there are statistics, through 1904 show a rapid increase, except for the slump in 1904. They show a relatively greater increase in basic than in acid open-hearth castings and in Bessemer than in open-hearth castings. From 1898 to 1901 basic castings aggregated less than a fourth the total of open-hearth castings: in 1903 and 1904 they constituted nearly a third. While the open-hearth casting production in 1904 dropped almost to the tonnage of 1901, the pro-

duction by the Bessemer process, although relatively insignificant, increased from 1901 to 1904 by 137 per cent. A great increase from the 1904 production is to be expected for 1905, and 1906.

All the statistics which have been gathered on the production of direct steel castings in the United States are presented in the following table:

Production of Direct Steel Castings, gross tons.

	Acid Bessemer.	Basic Open-hearth.	Acid Open-hearth.	Crucible etc.	Grand Total
1898	3.539	28.460	92,127	7.811	131,937
1899	3,939	38,689	130,040	7,444	181,112
1900	6 467	42,644	134.847	8,845	192,803
1901	6.764	94,941	206.681	9,184	317,570
1902	12.548	112.404	255,475	10 508	390,935
1903	18,099	134,879	165,469	11,818	430,265
1904	16,051	98.929	203,915	11,326	330,211

Editorial in The Iron Trade Review.

EVERY MAN TO HIS CRAFT.

Nearly every man thinks that his craft or trade contains all of the difficult, or at least most of the difficult, work which has been done, and that there are more tricks and secrets in it than in any other. It is very common to hear the machinist say: "Oh, any one could pound sand and make castings," or to hear the foundryman say: "Why, machine work is dead easy—all you have to do is to set the tools and the machine does the rest. In the foundry it is all judgment, and you have to know how to do things." Whenever one of these men tries to do the other's work, however, he finds himself in a peck of trouble, and when one of them attempts to help the other he sometimes makes a good deal more than a peck of trouble.

This is well illustrated by an occurrence which came under the writer's notice recently. A foundry had been making some flat castings with a great many holes cored in them by means of small chilled cores. The castings varied from 15 to 43 inches in length and averaged about 18 inches in width. They weighed from 8 to 28 pounds and were ¼ inch thick. Experience had shown the foundryman that to produce straight castings it was necessary to use a crooked pattern. These patterns had been made a long time ago, giving the proper set provided with match board, and everything was going nicely. Finally one of the patterns became detached from its gate, and the tool maker was asked to fix it. In doing so he discovered that it was crooked, and proceeded to straighten it. When he returned it to the pattern storage he discovered that all of the others were crooked, and without saying anything to any one, straightened them all.

In a short time an order for some castings was received, and the patterns were taken to the foundry. The usual sand matches were made up and the work started, but lo and behold! all of the castings came out crooked. So far as the foundry management knew, the patterns were exactly as they had always been, and hence everything but the patterns were blamed. The foundry mixture was looked over carefully, but it was exactly the same mixture that had been used for some time, and the other castings had given no trouble. They were also using the same coke and the same molding sand and the molds were being put up by the same men. Nevertheless, the castings came out from ¼ to ⅜ inch crooked. It was some time before the real cause of the difficulty was discovered and the proper kink put into the patterns.

We presume that the idea of anything crooked or out of line must have hurt that tool maker's sense of eternal fitness of things, and we believe that he has more respect for the molder who can take a crooked pattern and produce a straight casting than he had formerly

A REMARKABLE FOUNDRY CAREER.

Few men ever give a full life's work to the foundry, but the foundry business has been fortunate in having devoted to it some faithful, strong lives. One of the most remarkable of these men is Mr. T. R. Pickard, who is just retiring from the active management of the foundry of the Bass Foundry & Machine Co., of Fort Wayne, Ind., and we believe that a sketch of Mr. Pickard's experience will not only be of interest to foundrymen, but will serve as

an inspiration to many a young man in this great industry.

Mr. Pickard was born in Cornwall, England, Dec. 20, 1829, and came to the United States in May, 1848, with his parents, locating in Mt. Vernon, O. He served an apprenticeship as a molder with the firm of C. & J. Cooper &

T. R PICKARD.

Co., remaining until 1854 when he moved to Fort Wayne and entered the employ of Cooper, Bass & Co., who were engaged in the manufacture of engines and general machinery. Two years were spent in the employ of this firm and then he returned to Mt. Vernon and entered the employ of Cooper & Co., where two more years were spent. In 1858 he returned to Fort Wayne, and took up his work with Cooper, Bass & Co. once more. This company was succeeeded by J. H. Bass and later by the Bass Foundry & Machine Co., of which Mr. Bass is president. Consequently Mr. Pickard has been in the employ of the present establishment for 50 years, 48 years of which have been spent in the capacity of foreman and superintendent of the foundry department.

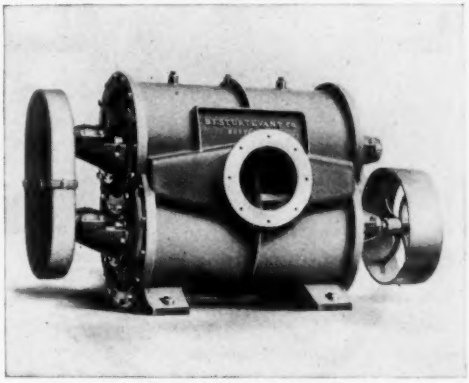
In the early days referred to, there were nine molders and six helpers employed in the foundry, but the growth of the business was rapid, so that the works have developed to their present magnificent proportions, employing more than 1,200 men the year round. In February, 1862, the company began the manufacture of car wheels at the rate of ten per day, there being at that time only one other concern west of the Alleghenies engaged in that line. The manufacture of car wheels has ever since been one of the leading features of this establishment, and today it is one of the largest producers of car wheels in the country.

Mr. Pickard is not planning to give up active work and retire from the service of the company, as they do not wish him to retire, but at his request he is to be relieved of many of the details of the management of the foundry department, as he feels that, in view of his long service, he should ease up and prepare to let some younger man take active charge of the work. The accompanying photograph was taken about a year ago, on the 50th anniversary of Mr. Pickard's marriage. Both Mr. and Mrs. Pickard are in the best of health, and we are sure that not only THE FOUNDRY, but all of those engaged in the foundry trade, wish both Mr. and Mrs. Pickard many years of happy life, and hope that with lighter duties he will have more time to enjoy the good things of this world.

CONSTRUCTION OF THE STURTEVANT HIGH PRESSURE BLOWER.

The Sturtevant high-pressure blower is made in two types: in the horizontal, the two shafts lie in a horizontal plane, while in the vertical one shaft is above the other. The blower consists of a cast-iron shell or housing in which are two rotating members or "rotors." One of these, the impeller, revolves in the larger portion of the casing which in the vertical type is the lower. It does the real work of compression. The other rotor, known as the idler, does no work; it successively provides spaces or chambers of proper shape at the desired points in the revolution, so that the impeller blades may return to the suction side of the blower without allowing the escape of compressed air.

Ample clearance between the rotating members and the casing insures high mechanical efficiency by absolutely preventing internal friction due to contact of metal surfaces. Between the idler and the impeller the space is so great that only excessive variation in the accurate running of the gears will allow the two rotors to come in contact. This clearance is at least one-eighth inch in small



STURTEVANT HIGH PRESSURE BLOWER

blowers and in large sizes one-half to three-quarters inch.

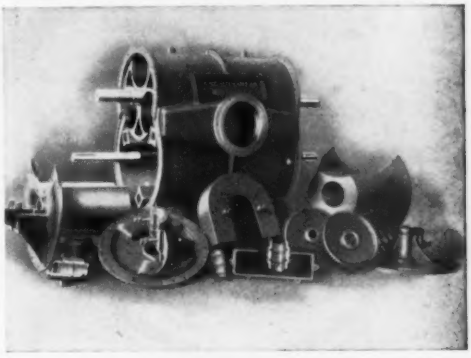
The idler or drum, revolving in the smaller part of the casing, which in the vertical type is above the impeller, is symmetrical and has a periphery nearly a complete circle. It consists of three hollow vanes or blades cast in one piece with the shaft which is of cast iron, very rigid, and of ample strength to transmit the little power necesary for rotation. The idler, revolving with large clearance, is turned at the same speed as the impeller by means of two spur gears running in oil and incased for protection against dirt and accident.

The impeller mounted on the driving shaft is made up of three diamond-shaped bars or blades and a central web keyed to the steel shaft. Being symmetrical it is perfectly balanced at all speeds. As it revolves three separate pockets are formed in the annular space between the shell and a core extended lengthwise of the lower part of the casing. In reality the core is in two parts, each cast in one piece with the end plates, the space between them allowing the web to revolve.

The cast iron shell or casing consisting of two hollow cylinders partially intersected, is accurately bored and amply strong and rigid to withstand the strains due to handling, setting on foundation, and operation at high pressure. The ends of the casing are finished to receive the four cover plates in which are cast chambers or passages for lessening the noise and increasing the efficiency of the machine, as is explained under "Operation." On either side of the housing are openings for the intake and discharge of the air, flanged and tapped for standard gas pipe fittings; the small sizes have openings at the sides and the large blowers openings at the top and bottom. In every respect the casing and rotors are symmetrical, permitting the blower to run in either direction.

Except in blowers of large size, the lower half of each journal box is cast in one piece with the cover plate, insuring rigidity, simplicity, and the correct alignment. The boxes, except those for very small blowers, are of the ring-oiling type, lined with Sturtevant white metal, hammered in, and accurately bored.

When it is desired to maintain absolutely constant pressure, the blower is provided with a relief valve, or automatic governor. For transferring gases and air at high pressure, stuffing boxes are pro-



PARTS OF BLOWER.

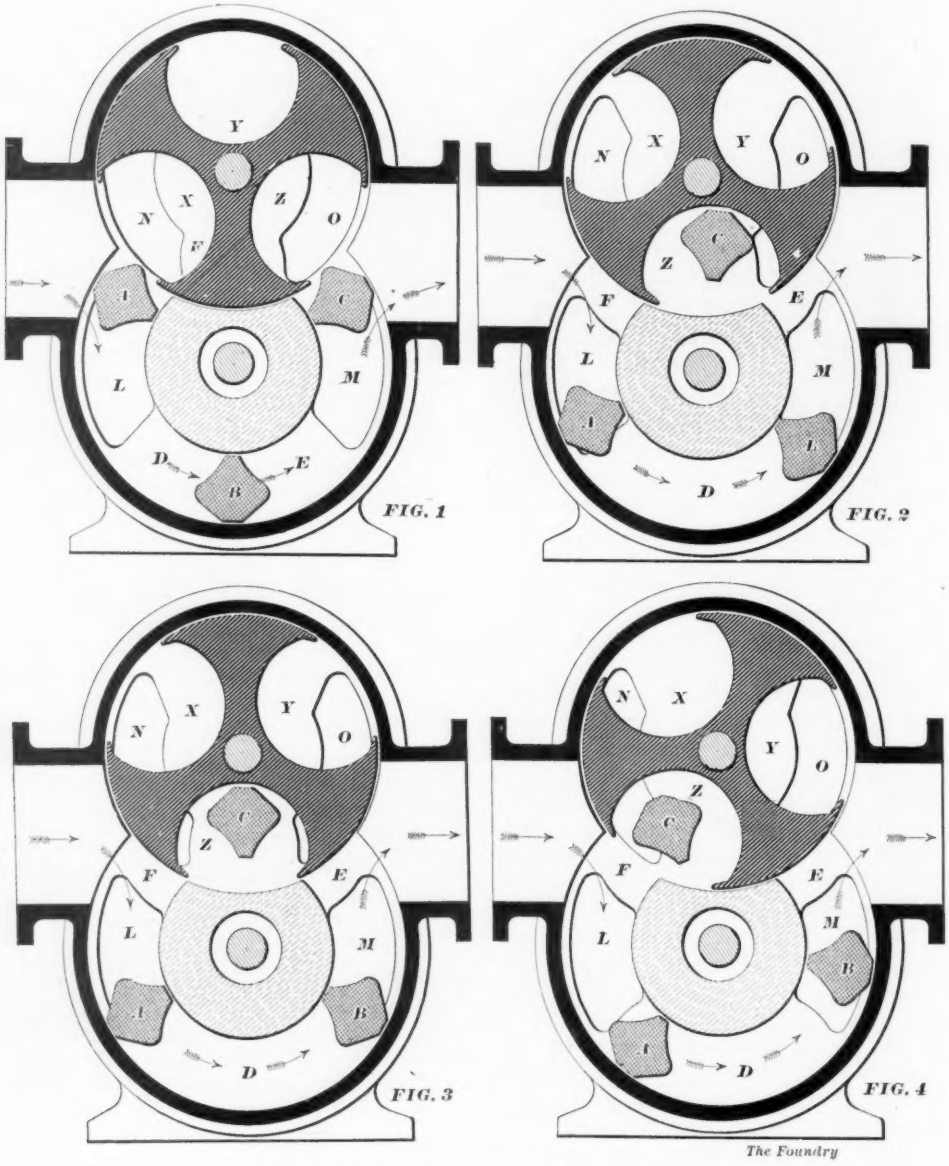
vided for the shafts, and a drain in the bottom removes tar and other distilled liquids.

Operation.

Air at atmosphere pressure entering the blower at the intake is successively imprisoned in the three pockets formed by

the three blades of the revolving impeller, and discharged at any desired pressure up to ten pounds per square inch. The volume of free air delivered varies directly with the number of revolutions; is running at a speed to produce average pressure, and that this pressure exists in the discharge outlet.

While the rotating members were in the position shown in Fig. 1, air entered



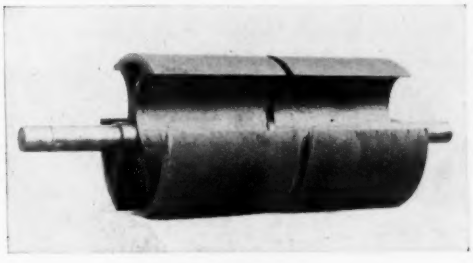
ACTION OF HIGH PRESSURE BLOWER.

the pressure varies with the resistance met in the delivery pipe.

The principle upon which the blower operates is clearly shown by the accompanying diagrams which are sectional views of the rotors and casing. In the explanation it is assumed that the blower freely and completely filled chambers X and D, while pockets E and Z were discharging air to the delivery pipe. From the previous movement of the rotors, the pressure in Y, filled with air carried over by the revolving idler, had been increased slightly by air flowing through

the leakage passage N as will be explained later. The space between blades A and C, just above the concave portion of the core, was practically filled by the wing of the idler, and consequently while in this position it took no part in the action.

While revolving from the position of Fig. 1 to that shown in Fig. 2, the air in pocket D has been carried along,



THE IDLER.

and the communication between chamber D and the inlet has been cut off. Space Z is filled with compressed air which further movement will carry toward the suction end where it will flow back to the inlet and in escaping cause noise. But this loss and noise is prevented by the leakage chamber O which allows the pressure to be transmitted to the air in space Y thereby increasing its density just before it is discharged.

Continued rotation carries the rotors to the position shown in Fig. 3; atmospheric air is now entering pocket F, the air in D is being carried around between the blades A and B in the annular space, and E is discharging. Above the impeller the remaining pressure in Z is being transmitted to the air in X by means of the leakage passage N provided for the purpose, thereby making its pressure a little greater than atmospheric. The air in space Y under slight pressure from previous leakage is imprisoned, and being carried around by the idler.

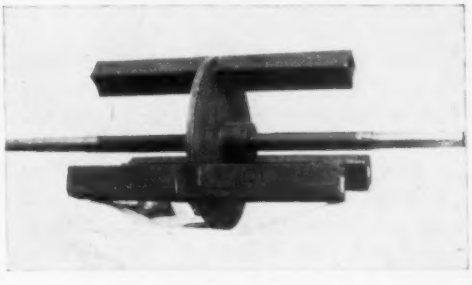
When the fourth position is reached, pocket F will be filling, the pressure in chamber Z will have been reduced to atmospheric by leakage, space Y will discharge and a little compressed air from the delivery pipe will flow back through leakage passage M and increase the pressure in D which will result in a quieter discharge when further movement brings B into the discharge passage.

The purpose and advantage of the leakage chamber is now apparent; they make it possible to recover the pressure tending to escape from the impeller pockets and by making the increase in pressure gradual cause the blower to run with less noise. Leakage passage L has little effect when the blower runs in the direction shown here; it is made to allow the blower to be reversible.

It will be noticed that the impeller carries three blades, set at equal distances around the periphery, thus causing three admissions of air at each revolution. Upon leaving the position shown in Fig. 4 the rotors quickly reach a position in which the conditions are exactly the same as those shown in the first figure, the operation continuing as explained.

Selecting Blowers.

In selecting a blower for the foundry it is customary to rate the volume of air according to the maximum amount of iron which the cupola can melt. The capacity of the cupola being known, the size of the blower may be found from the fourth column of the accompanying table. If the maximum output is not known the diameter of the cupola becomes the basis for computation, the first column of the table giving the usual capacities for the diameters given in the second column. The values in the third column are based on 30,000 cubic



THE IMPELLER.

feet of air per ton of iron; our tests show this to be a fair average, although 25,000 to 40,000 cubic feet may be required, depending upon the local conditions and method of operation. In case a given cupola requires less than 30,000 cubic feet per ton, the blower will melt a larger amount of iron than that given in the table.

Foundry Table for Sturtevant High Pressure Blowers.

Tons iron per hour	Usual inside diam. cup. for work, inches	Cu. ft. of air per min.	No. of Blower	R P. M.
1	23	300	4	450
2	27	1,000	5	430
3	30	1,500	6	380
4	32	2,000	7	350
5	36	2,500	8	280
6	39	3,000	8	330
7	42	3,500	9	260
8	45	4,000	9	290
9	48	4,500	9	330
10	54	5,000	10	270
11	54	5,500	10	300
12	60	6,000	10	325
13	60	6,500	11	230
14	60	7,000	11	250
15	66	7,500	11	270
16	66	8,000	11	290
17	66	8,500	11	305
18	72	9,000	12	200
19	72	9,500	12	215
20	72	10,000	12	225
21	78	10,500	12	235
22	78	11,000	12	245
23	78	11,500	12	255
24	84	12,000	13	200
25	84	12,500	13	210
26	84	13,000	13	215
27	90	13,500	13	225
28	90	14,000	13	235
29	90	14,500	13	240
30	90	15,000	13	250

SWINGING CUPOLA SPOUT.

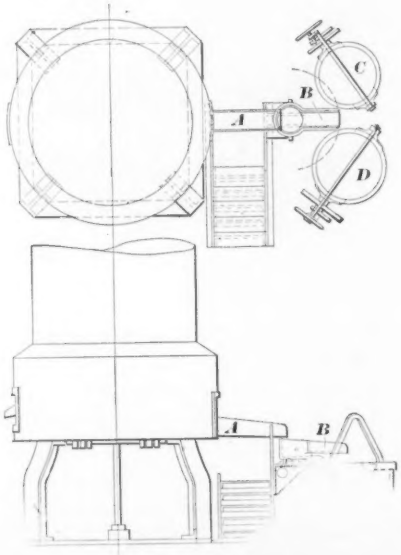
We have received a letter from Mr. Carmil L. Clover, describing a new cupola spout, which he has invented and patented. The spout is illustrated in the accompanying cut, in which A is the regular stationary cupola spout, and B the swinging spout. By this arrangement, the stream of iron can be directed into either of the ladles, C or D.

The advantages to be derived from such a device, where a large number of crane ladles are used, will be readily appreciated by all foundrymen.

If a piece is to be cast which requires two ladles, the iron can be tapped into first one, and then the other, alternating, until both are filled. In this way, the temperature of the metal in both ladles will be more uniform, and both will have the same temperature when the time for casting arrives.

The device also reduces the amount of handling required, in changing the ladles by the ordinary method; with the ordinary arrangement, the crane brings an empty ladle, sets it down near the spout, picks up the full ladle, places it on the floor to one side, then takes up the empty ladle again, places it under the spout, and finally, picks up the full ladle, for the second time.

When the double spout arrangement is used, the crane brings the ladle and places it at one side of the one already filled. It next picks up the full ladle and the melter swings the spout to the empty ladle.



A SWINGING CUPOLA SPOUT.

It is true that in some cases, a special jib crane is placed above the cupola spout to handle the ladles in the manner mentioned, but this takes extra time, power and attention, and is at best only a makeshift.

The spout mentioned has been in use in an ingot mold foundry for over a year, and during that time, has only required lining four times, the heats averaging 120 tons per day. The spout is lined with a good grade of fire brick. In light work shops, it would not require as heavy a spout as the one illustrated, but in cases where truck ladles are used in carrying the metal to the floors, the swinging spout would undoubtedly be found advantageous.

A NEW GASKET.

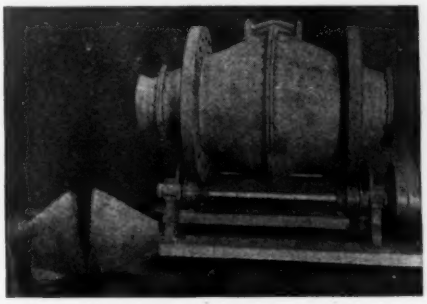
Gaskets for joining pipe for carrying steam, air or water, under pressure, have always been a source of trouble and inconvenience in all classes of manufac-

ture and to all plant operations.

An interesting gasket has recently been brought out by The Smooth-On Manufacturing Co., Jersey City, N. J., which consists of a thin, corrugated iron gasket, which is treated with a coating of metallic iron cement on each side, and then clamped in the joint. The spring of the corrugated metal tends to keep it in constant contact with the surfaces, and together with the metal cement, makes a tight and permanent joint, which is air, water or gas tight, can be easily and quickly taken apart and then replaced. The joint is very thin. It will not leak when hot or cold, due to unequal expansion, and will not cause electrolysis nor corrode the faces of the metal at the ends of the pipe or between the flanges.

A HANDY MACHINE FOR THE BRASS FOUNDRY.

A great many different types of grinding mills have been devised for crushing the slag skimmings, ashes, etc., resulting in the brass business, with the



A BRASS FOUNDRY GRINDING MILL.

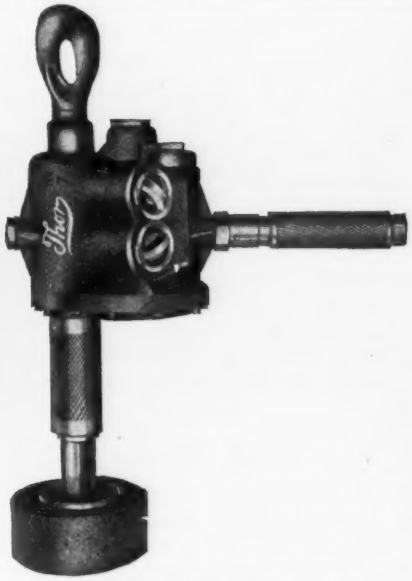
object of recovering the metal from them.

A successful machine of this type is shown in the accompanying cut. It consists of two conical castings, bolted together at the center, in which rotate two conical rollers, which are shown removed and standing at the left of the machine. The angle of the roller is made such, that they ride in the chamber with the upper part of the roller apart, as shown, any large chunks or pieces, which come between the rollers, are crushed at the lower part, where the parts come in closer contact. The finely crushed material is then ground to a powder between the circumference of the rollers and the lining of the grinder, so that the action results in a combined crusher and pulverizer. The machine can be worked either dry or wet; and the makers claim that, with the combined crushing and pulverizing action, the material can be reduced to a powder in half the time required with the ordinary apparatus.

The device has been patented by O. J. Ossette, whose works, for the manufacture of the same, are located at the corner of Driggs avenue and north Tenth street, Brooklyn, New York.

A PORTABLE GRINDING RIG.

The Independent Pneumatic Tool Co., of Chicago, Ill., and New York, has placed on the market a new air driven machine



A PORTABLE GRINDING RIG.

called the "Thor" pneumatic grinder No. 7. This machine is designed for grinding, polishing and buffing irregular surfaces. The spindle can be driven approximately to 3,000 revolutions. All of the parts are so designed as to reduce wear to a minimum and make the machine run very freely. The motor and shaft run in a bath of oil. The machine weighs approximately 24 pounds, and consumes

24 cubic feet of air per minute. It can be easily and rapidly handled.

PERSONALS.

Samuel L. Rockfellow, who has been superintendent of the Genesee Valley Mfg. Co. of Mt. Morris, N. Y., since 1879, has retired. The business was formerly conducted by Mr. Rockfellow and Mr. Frank Sleeper under the name of Rockfellow & Sleeper. At that time the principal product was water wheels. Later, Mr. F. A. Hill's grain drill was brought from Jefferson City, Mo. and manufactured by the company and is now the principal product. The retiring superintendent is nearly 80 years old, but is still well and active.

R. M. Barnett, proprietor of the Brass Founders Supply Co., of Newark, N. J. was presented with a handsome office chair as a Christmas gift from his employes in the finishing department. This came as a little token of the good feeling which exists between master and man in the company.

Thomas Fox has been made superintendent of the foundry of Van Bergen & Co., of Carbondale, Pa.

Harry Fisher, who has been superintendent of the Buffalo Foundry Co.'s foundry at Buffalo, N. Y., for the past two years, has resigned and accepted a position as superintendent of the Bass Foundry & Machine Co., of Fort Wayne, Ind. where he succeeds Mr. T. R. Pickard, who has been connected with the Bass Co. for 51 years.

Mr. A. E. Hoermann, who has been connected with the Curtis & Co. Mfg. Co., of St. Louis, Mo., for several years as chief engineer, left the above mentioned company on Dec. 1, and opened an office at 261 Broadway, New York, as "Manufacturers' Agent," and will make pneumatic machinery a specialty. He will represent the Curtis & Co. Mfg. Co., the Dayton Pneumatic Tool Co., of Dayton, O. and F. F. Slocomb & Co., of Wilmington, Del.

J. O. Barnett, who since July 1, 1901 has been purchasing agent for the United Engineering & Foundry Co., Farmers' Bank building, Pittsburg, has been appointed manager of the chilled roll department of the company's plant at Vandergrift, Pa., and will have his headquarters at the Pittsburg office and be in charge of the manufacture and sales of steel castings and brass. He will be succeeded as purchasing agent by Mr. H. A. Grusch, formerly assistant purchasing agent. Before becoming connected with the United Engineering & Foundry Co., Mr. Barnett was with the Frank Kneeland Machine Co., going with that company in 1894.

Thomas Morris has resigned as iron tester for the Springfield Malleable Iron Co., Springfield, O., after a service there of a third of a century. He is the inventor of a process for the manufacture of malleable iron, having made a study of that trade in Scotland before coming to America.

Phillips Isham of the New York office of Rogers, Brown & Co., sailed for Europe on December 20. He will be absent six or eight weeks.

T. H. Simpson, vice president and general manager of the Michigan Malleable Iron Works, Detroit, Mich., has gone abroad for a three months' trip.

DEATHS.

Mr. John W. Paxson, founder of the J. W. Paxson Co., of Philadelphia, died Jan. 3 at the age of 87 years. Mr. Paxson was brought up in Bucks county, Pennsylvania, and after working for a time in a grocery store, started in the molding sand business in Philadelphia in 1855. In 1861 he enlisted and served in the Civil War until 1863. After the war he set about increasing his molding sand business and also dealt in foundry supplies. Later he was joined by J. K. Bougher, who is now the president of the J. W. Paxson Co. and by Howard Evans, who is now the vice president. H. M. Bougher, secretary and treasurer, J. S. Hibbs, assistant general manager, and S. C. Bougher, purchasing agent, came to the company as time went on. The business has increased almost every year, until it has grown to be one that is known all over the country. Mr. Paxson was a member of the Society of Friends and a man who in every way possible avoid-

ed display. Before his death he requested that it should not be made public, but his life work certainly stands out clearly and is one to be proud of and he leaves many friends who will mourn his loss. One daughter, Mrs. Edgar J. Howes, survives him. Mr. Paxson was very fond of travel and had visited most of the prominent cities of the world, having crossed the ocean eighteen times.

William Schlott, president of the Eagle Foundry Co., of Belleville, Ill., was found dead in his bed on the morning of December 17, death having resulted from general break down caused by an attack of typhoid fever 3 years previous. He was 63 years of age and had been in the foundry business in Belleville since shortly after the Civil War.

Henry A. Osborne, who has been conducting a brass foundry in New Britain, Conn., died on January 3. Early in the afternoon of Jan. 2 he complained of feeling ill and two physicians were called but were unable to relieve him. It is thought his death was due to appendicitis. Mr. Osborne was 73 years old and had resided in Plainville for a good many years. He had always been active in matters of public interest and was one of the well known men of that region.

Mr. Jacob H. Hills, who was, for many years, a resident of Lorain, Ohio, as superintendent of the Lorain Brass Manufacturing Company, and later, a partner in the hardware business of Chapman & Hills, and who, for the past fifteen months, has been associated with his brothers, C. J. & A. S. Hills, in the management of the Brass Works of the Haydenville Company of Haydenville, Mass., died at Haydenville, of pneumonia on December 24. Mr. Hills was fifty years of age, and had a long and valuable experience in the manufacture of brass goods. He also had marked ability in the handling of men, and was universally esteemed by his associates, so that he leaves many friends in the places where he has so conscientiously labored.

FIRES.

The DeKalb Iron Works, Auburn, Ind., sustained a loss of $10,000, Dec. 23 when the plant was practically destroyed by fire supposed to have been started by a hot casting.

The foundry of the Milwaukee Steel Casting Co., Milwaukee, Wis., sustained a loss of about $5,000 through fire Dec. 14, when the second and third floors of its buildings, devoted to storage purposes, were gutted by flames.

The manufacturing plant of the C. T. Rogers Co., of Detroit, Mich., situated at the corner of McKinley avenue and the Lake Shore railway tracks, was destroyed by fire on Dec. 15.

The foundry and pattern shop of Cyrus Currier & Sons, of Newark, N. J., was visited by a disastrous fire on Dec. 16. The fire started in the foundry, but owing to the arrangement of several small buildings in the vicinity it was impossible for the firemen to control the flames until they had spread to the adjoining pattern shop and both buildings were partly destroyed.

The foundry building of the Ruggles Machine Co., of Poultney, Vt., was destroyed by fire on Dec. 9, with a loss of $10,000, which is covered by insurance.

The plant of the Colebrookdale Iron Works, at Colebrookdale Station, Little Oley P. O., Pa., was destroyed by fire on Dec. 23. The loss was between $2,500 and $3,000, fully insured. The company manufactures flat irons and hardware specialties, and it is said that the plant will be rebuilt at once.

The building in which Wm. H. Hall & Co., of Boston, Mass., conduct their brass foundry, was badly damaged by fire on December 12. The total loss amounted to about $20,000.

NEW CONSTRUCTION.

The work of repairing the Ruggles Machine Co.'s foundry at Poultney, Vt., is progressing rapidly. The foundry was recently destroyed by fire.

The Stanley Electric Manufacturing Co., Pittsfield, Mass., is planning the erection of an iron foundry on the site recently purchased. The structure will be 200 x 400 feet.

A large foundry is to be built at

North Tonawanda, N. Y., by the Buffalo Forge Co.

The Climax Specialty Co., of Seneca Falls, N. Y., is increasing the capacity of its foundry by the construction of a building 40 x 90 ft. The work is to be completed by next spring.

The Mead Drill Mfg. Co., has removed its plant from Burdett to Geneva, N. Y., where it will construct a plant for the manufacture of grain drills and other implements. A foundry, 50 x 100 ft. will be erected, a machine shop 40 x 50 ft., a three-story warehouse, 50 x 125 and an office building, all of which will be of fire proof construction.

The Westinghouse Machine Co., has completed its branch plant at Attica, N. Y. It consists of five modern buildings of steel and brick construction. The machine shop is 100 by 250 ft., and it is expected that its length will be tripled in the near future. A foundry, blacksmith shop, pattern shop and a power house complete the group of buildings which are to be devoted exclusively to the manufacture of mechanical stokers and gas producers. Five hundred men will be employed at the outset.

The Union Ballast Co., New York, has awarded the contract for the designing and erecting of a new foundry at its plant at Long Island City to the Miller-Collins Co., New York. The building will be constructed of structural steel with plank and composition roof, and concrete block walls on pile foundations. The company has not yet placed the contracts for its requirements.

The large new foundry which the H. L. Dixon Co., is erecting at West Carnegie, Pa., is expected to be finished Feb. 1.

The McKerahan Automatic Car Coupler Co., Wilmerding, Pa., recently organized to manufacture its car coupler, is planning for the erection of a plant which will be located near Pittsburg, the site for which has not yet been chosen. The steel foundry will be 50 x 150 ft. The officers of the company are: C. A. McKerahan, president; William McDwett, treasurer and W. W. Brush, secretary.

The Standard Roller Bearing Co., Philadelphia, has started the erection of a brass and iron foundry 60 x 125 feet, two stories. Its crucible steel casting plant was placed in operation during the past week, in a new building 60 x 95 feet.

The Steel Foundry Co., of Cincinnati, O., recently incorporated, has elected the following officers: William Lodge, president; Franklin Alter, vice president; J. C. Hobart, treasurer, and W. H. Stewart, secretary. The old Abbey property adjacent to the Chester Park car shops has been purchased and several buildings will be constructed.

The main building will be 135 x 260 feet. The administration and power building and pattern shop and pattern storage will be 30 x 140 feet, and two stories in height. The company expects to have the buildings completed and the plant in operation by April 15.

The Standard Pulley Co. and the Kisinger-Ison Co., of Cincinnati, O., have purchased land on Spring Grove avenue and are having plans prepared for a foundry and a machine shop. The former will be 110 x 170 feet and the latter 65 x 170 feet.

The new foundry of the Deming Pump Co., of Salem, O., has been started.

Work has been started upon the new steel plant to be constructed by Hetherington & Berner at Indianapolis, Ind. The plant will consist of a foundry 80 x 180 feet; machine shop, 60 x 160 feet; pattern shop and warehouse, 60 x 130 feet; office building and drafting department, 60 x 125 feet.

The new foundry at the Fort Wayne Electric Works, at Fort Wayne, Ind., is practically completed.

The Rockford Mfg. Co., Rockford, Ill., has under construction a new foundry building 30 x 80 feet, which it will occupy early in the year.

The Ajax Forge Co., of Chicago, Ill., has taken out a building permit for the construction of a $15,000 1-story brick foundry on Blue Island avenue.

The Aurora Foundry Co., of Aurora, Ill., is planning a number of improvements to be carried out in the spring.

The Bayley Structural Iron Co., of Milwaukee, Wis., is having plans prepared for foundry buildings to be constructed early in the spring. The buildings will cost $30,000 and the company expects to spend an additional $40,000 in equipping them. Chas. D. Crane is the architect preparing the plans and H. F. Bayley is the head of the new company.

The Chicago, Milwaukee & St. Paul R. R. Co. has put in a foundation for a new pattern shop 80 x 80 feet which is to be three stories in height and of fire-proof construction, as an addition to its shops at West Milwaukee, Wis. Many other minor improvements have also been made.

John F. Gaurs has purchased the business and property of the J. L. Doblins Furnace Co., of Marshall, Mich., and will erect a large foundry in Marshall.

The Grand Rapids Foundry Co., of Grand Rapids, Wis., has moved into its new plant, which was designed by O. C. Ueling. The two buildings are of steel and concrete construction, one being 72 x 136 feet and the other 60 x 110 feet.

An addition 30 x 90 feet is being erected at Parker & Topping's Northern Pacific foundry, Brainard, Minn. The company has on hand large car orders which necessitate the increase in equipment.

The West Allis Malleable Iron & Chain Belt Co., West Allis, Wis., has just completed improvements which will double the company's capacity. A foundry addition 70 x 224 feet with reverberative furnace and two more annealing ovens and a two-story addition 70 x 64 feet to the shipping room and machine shop, installed with a battery of 12 sly barrels, are ready for operation.

The Buhl Malleable Iron Co., Detroit is preparing to increase the capacity of its plant by the erection of two buildings, one 45 x 100 feet and the other 80 x 180 feet. These will be finished by February when probably 150 more men will be employed.

An extensive addition is to be made to the plant of the Central Foundry Co., at 591 Ferry street, Newark, N. J. The addition will cost $20,000 and will be of concrete and steel construction, 99 x 149 feet.

M. W. Kellogg & Co., 37 Dey street, New York, are building a new foundry in Jersey City, N. J. The plant will be ready for operations in about two months.

The enlarged foundry of Louis Sacks, Newark, N. J., is ready for occupancy. The addition just completed is 100 feet long making a total floor space in the building of 200 by 50 feet.

Harry Waterhouse, of Wheeling, W. Va., has purchased the brass foundry business of N. W. Beck and will make a number of improvements to the plant.

The foundry of the Price & Evans Foundry Co., of Chattanooga, Tenn., was destroyed by fire on December 30. The plant will be rebuilt at once on a new site and the main foundry building will be of brick and steel construction, 110 x 160 feet.

The United States Cast Iron Pipe & Foundry Co., is making extensive improvements and changes in its plant at Bessemer, Ala., including the introduction of an electric crane for handling the cores and other labor saving appliances.

The malleable department in connection with the Anniston, Ala., plant of the Western Steel Car & Foundry Co., is to be increased to double its present capacity.

The brick work for the new foundry and machine shops for the Fisher plant at Fourth and Choctaw streets, Leavenworth, Kan., has been completed. About $40,000 has been spent on the plant thus far.

C. F. Groenke, proprietor of the Sound Iron Works, which will soon be moved from Everett, Wash., to Chehalis, Wash., has broken ground for his foundry buildings at Chehalis. The main building will be 40 x 120 and the smaller building 24 x 60. Other small buildings will be erected later.

Bowdry & McKinley, of Fort Worth, Tex., are building a new iron foundry which they hope to have in operation in the near future.

The Waterman Car Wheel & Foundry Co., of Houston, Tex., has been incorporated with a capital of $50,000. The incorporators are G. H. Hermann, W. H. Watermann, A. J. Binz and J. J. Settegast. The main building will be 100 x 235 feet.

R. H. Hoffman has completed his new foundry building, which is 54 x 56 feet, at Clarkston, Wash., and the foundry is now in operation.

The United Iron Works Co., Springfield, Mo., is erecting new machine shops and foundry at Aurora, Mo., which includes a main shop 80 x 150 feet, a boiler house 30 x 30 feet, a foundry 40 x 65 feet, a blacksmith shop 25 x 35 feet, and an office storage house and fuel building. The equipment in the old plant at Aurora will be moved to the new buildings.

The Lennox Furnace Co., Marshalltown, Ia., has broken ground for a foundry building 50 x 140 feet and will make the castings needed in its other departments.

GENERAL INDUSTRIAL.

Wm. C. Houghton, Director of the Wallham Manual Training High School, of Wallham, Mass., has put in a small brass foundry for this school. Mr. Wm. T. Nicholson, of the Cutter. Wood & Stevens Co., of Boston, Mass., supplied the outfit.

The contract for the foundry building of Landers, Frary & Clark, of New Britain, Conn., has been given to the Torrington Building Co.

The Household Foundry Co., Providence, R. I., has taken over the foundry department of the Household Sewing Machine Co. at that city and will turn out gray iron castings in loam, dry and green sand, castings in yellow brass, composition, phosphor-bronze and aluminum. The case hardening and annealing department will be operated in connection with the plant. James E. Dick, late superintendent of the foundry of the Whittier Machine Co., South Boston, will be general manager of the foundry.

Charles E. Dustin, as receiver of the Hartford Foundry Co., Hartford, Conn., has been authorized by the courts to continue the business for six months in order to work up a quantity of raw materials now on hand into finished articles in which shape they can better be disposed of.

The Cape Ann Tool Co., Rockport, Mass., has been incorporated to conduct a foundry. The capital stock is $16,000, and the officers are: President, William H. Hastings, Malden, Mass.; treasurer, J. J. Dean; and clerk, F. S. Morse, both of Rockport, Mass.

The Lundin Steel Casting Co., Cambridge, Mass., has been incorporated to deal in steel castings, etc., with a capital of $25,000. The officers are: President, A. G. Lundin, 17 Taylor street, Neponset, Mass.; treasurer and clerk, W. A. Thibodeau, 95 Hammond street, Cambridge, Mass.

The Hotchkiss Foundry Co., Torrington, Mass., has been incorporated with the following officers: President, Walter A. Hotchkiss; secretary and treasurer, Henry S. Tallard and Charles F. Parent, director.

The opening of the new foundry of the Gleason Works, Rochester, N. Y., was celebrated by a dance and pedro party, on Dec. 30.

The Brown-Lipe Gear Co., of Syracuse, N. Y., has been incorporated with a capital of $150,000 to manufacture gears and operate a machine shop and foundry. The incorporators are: Alexander T. Brown, H. Winfield Chapin and Willard C. Lipe, all of Syracuse, N. Y.

The Howard Iron Works, of Buffalo, N. Y., has been re-organized and the capital stock increased. The new officers of the company are H. S. Madden, president; R. W. Gardner, vice president and secretary; F. S. Porter, treasurer; H. L. Lewis, O. N. Gardner and G. H. Gardner, are also directors of the company.

The Syracuse Malleable Iron Works, Syracuse, N. Y., has been incorporated with a capital stock of $50,000 by W. B. Burns, Lyman Smith and Basil B. Ayuesworth, all of Syracuse.

The Ingersoll-Rand Co., of New York City, announces that it has secured exclusive control of the product

of the Imperial Pneumatic Tool Co., of Athens, Pa. The Imperial line of tools is well known and complete. The Ingersoll-Rand Co. is the manufacturer of the Haeseler pneumatic tools and hence it is now able to offer the public its choice of either brand.

The new foundry of the Reading Iron Works, of Reading, Pa., is expected to be in operation early in the spring. The building is now completed and the equipment is being installed rapidly.

W. H. Tong, of Horseheads, N. Y., has purchased the Wellsboro Foundry & Machine Works, at Wellsboro, Pa., which has been conducted until recently, by the firm of Wheeler & Apsey. Mr. Tong has taken possession and will carry on the business.

The Buckwalter Stove Co., of Royersford, Pa., is now in full charge of its new purchase, the Royal Gas Stove & Foundry Co. Abram Buckwalter is superintendent and H. P. Raysor is foreman of the molding room.

The Caldwell Process Foundry Co., of Philadelphia, has been incorporated to do a general foundry business. Capital stock, $500,000.

The North Lebanon Foundry Co., of Lebanon, Pa., has been incorporated to carry on a general foundry business.

The American Production Co., Reynoldsville, Pa., recently taken over by the Pittsburg Industrial Iron Works, Westinghouse Bldg., Pittsburg, has been put in operation, the foundry turning out about five tons of iron per day, and the brass foundry casting every other day. The new company in control is designing contractors' and rolling mill machinery.

The directors of the Carnegie Technical Schools, Pittsburg, have let the contract for the erection and equipment of a model foundry to include a 7-ton Whiting cupola, Whiting foundry elevator and No. 6 Sturtevant steel pressure blower with Morse chain drive to 15 horsepower motor.

The plant of the Delaware River Steel Castings Co., Chester, Pa., was purchased for $140,000 at the recent trustees' and receivers' sale by William B. Broomall, acting presumably for the bondholders. It is reported that the works will soon be placed in operation. Among the raw materials sold separately was a quantity of ferromanganese iron which was bid in at $131 per ton by John J. Hayes, of Chester.

The Dayton Pneumatic Tool Co., of Dayton, O., recently added considerable new equipment to its factory, which will increase its output to about 300 hammers per month.

The Watt Cupola Twyer Co., of Barnesville, O., has made a new contract with the Thomas W. Pangborn Co., of New York City, by which the latter company is made exclusive agent for the Watt cupola twyer for the New England States, New York, New Jersey, Pennsylvania, Maryland, Delaware, Virginia and West Virginia. This gives the Pangborn Co. more territory in which to push the twyer.

The American Rolling Co., of Middletown, O., is erecting an addition to its plant to be used as a foundry.

The Simpson Heater Co., of Newark, O., was recently incorporated with a capital of $10,000, by John H. Simpson, Cora M. Smith, William L. Smith, Jesse Flory and Charles L. Flory. The company recently built a new foundry on Vale street, in North Newark, and will manufacture furnaces and heating appliances.

The Ferro Machine & Foundry Co., of Cleveland, O., has been incorporated a capital of $250,000, by E. W. Oglebay, F. S. Masten, J. T. Leitch, N. B. Snavely and Crispin Oglebay.

The Williams Foundry & Machine Co., of Akron, O., is making extensive improvements to its plant and installing considerable new machinery.

The Niles Boiler Co., Niles, O., will start its foundry Jan. 1. It has cupola capacity for 50 tons of iron per day, and is commanded by a 20-ton electric traveling crane, besides being supplied with all necessary trackage for handling materials to advantage. H. S. Pell, who recently assumed charge of the company, has had large experience in boiler shop and foundry practice. For a num-

ber of years he was superintendent with James P. Witherow & Co., New Castle, Pa., in building blast furnaces and steel plants, and for 10 years was engineer and superintendent of the Stirling Co., manufacturer of water tube boilers.

The Troy Fdy. & Machine Co., recently incorporated at Troy, O., is now erecting a plant in that city for the manufacture of heavy castings. A specialty will be made of soil pipe, but the new company has also made important contracts for furnace and machinery castings. J. W. Morris is president and Wm. M. Harp manager.

The work of dismantling the plant of the Portsmouth Foundry & Machine Co., Portsmouth, O., has been practically completed. Most of the machinery was shipped to a steel plant at Birmingham.

The George S. Anderson Co., of Jeffersonville, Ind., has been incorporated with a capital of $15,000, to carry on a general foundry and machine shop business. The incorporators are Charles Anderson, W. H. Lang, and Sarah C. Anderson.

The foundry and machine shop operated by William Dowling & Co., of Logansport, Ind., has been leased to James P. Karr and John D. Rauch, who will continue the business of manufacturing the "Little Giant" water wheel, and also manufacture a dredging machine, in addition to general foundry and machine shop business. The company will be known as the American Steel Dredge Works.

The U. S. Brass & Specialty Works, of South Bend, Ind., has increased its capital stock from $10,000 to $15,000.

The brass foundry department of the Wabash Railroad, which has been located at Decatur, Ill., will be moved to Springfield Ill., and all the brass casting for the company taken care of there. The gray iron castings, which have formerly been made in Springfield, will now be made at Moberly. The Decatur plant will be used for the manufacture of woodwork and other purposes. By this means the company will concentrate its brass foundry work in Springfield, gray iron work in Moberly, and other departments in Decatur.

The Oakland Foundry Co., of Belleville, Ill., has been incorporated with a capital of $15,000 by Henry Ehret, Hugo N. Ehret and Edw. Ehret.

The Gardner Governor Co., of Quincy, Ill., has decided to establish a branch foundry at La Grange, Mo., where it has secured a plant which will be remodeled and used.

The Buda Foundry & Mfg. Co., of Harvey, Ill., has increased its capital stock from $300,000 to $500,000.

The Columbia Heating Co. have removed their offices from No. 40 Dearborn street, Chicago, Ill., to Belvidere, Ill.

The Russell Economical Furnace Co., of Chicago Ill., has been incorporated with a capital of $6,000. The incorporators are Walter C. Wendell, Walter R. Howard, and Oscar O. Murray.

The Smith & Babbitt Brass Foundry Co., of Chicago, Ill., has changed its name to the R. M. Babbitt Brass Foundry Co.

The By-Product Coke Corporation, which has built 120 ovens at South Chicago, Ill., expects to have this plant in operation by the beginning of the new year. Pickands, Brown & Co. have been appointed exclusive sales agents for this coke.

The Prescott Co., of Menominee, Mich., expects to have its new foundry in operation by March 1. The equipment is now being installed.

The plant of the United States Cast Iron Pipe & Foundry Co., at Duluth, Minn., was closed on Dec. 10 for the winter season. The management expects to open the works about March 15, after some minor repairs have been made. The company has a large number of orders on its books and is looking forward to a prosperous year for 1906.

Cooke Bros. Iron & Brass Foundry, of Traverse City, Mich., is exected to be in operation by Feb. 1, with a capacity of 5 tons of iron and 500 pounds of brass per day.

A new manufacturing concern has been incorporated under the name of the Michigan Pipe & Iron Co., with a capital of $50,000, to be located at Rich-

mond, Mich. The company will manufacture iron culverts. The Acker iron foundry building, formerly occupied by the Cooley Bros., will be used by the new concern.

The Auto Brass & Aluminum Co., Flint, Mich., has increased its capital stock from $25,000 to $75,000 in order to accommodate its rapidly growing business in the manufacture of automobile and motor boat accessories. The company began business shortly before Jan. 1, 1905, and found the market for its products much wider than anticipated, the Buick Motor Co. of Flint taking the greater part of its output, with business offered by other concerns far in excess of its capacity. The officers are: James W. Heines, president; J. George Snyder, vice president; Thomas D. Buick, secretary-treasurer; O. M. Nacker, sales manager; and F. A. Wade, purchasing agent.

The Besser Mfg. Co., Alpena, Mich., has purchased the foundry of C. B. Warren in that city. It will make a number of improvements to enlarge its capacity in its specialty of marine repair work.

The American Brake Shoe & Foundry Co., Mahwah, N. J., is planning to make extensive improvements to its plants at Chicago, in New Jersey and at Chattanooga, Tenn. To accomplish this, $1,000,000 worth of bonds have been sold.

It has already been announced that Payne & Joubert, of New Orleans, La., would establish another plant at Birmingham, Ala. We now learn that the new plant will be conducted by a new company incorporated under the name of the Payne & Joubert Machine & Foundry Co., with a capital stock of $100,000. The officers are W. E. Payne, president; F. L. Joubert, secretary-treasurer; vice president and general manager, R. S. McKnight, of Birmingham, who resigns his position as district treasurer of the Republic Iron & Steel Co., to take charge of the new enterprise. Plans have been prepared for the new buildings, including a main building, 150 x 400 feet, together with other buildings for pattern shop, offices, etc. It is expected that the plant will be completed by May 1.

The business formerly conducted by Seymour R. Church, of San Francisco, Cal., has been taken over by Fair, Taylor & Co., who have purchased the interests of Seymour R. Church, including the several agencies handled by him. The new firm announces that it will carry on the business with the same care that has been execrised in the past, and will do all in its power to keep old friends and customers and make new ones.

The Gus Pech Foundry & Mfg. Co., of Le Mars, Ia., has been incorporated with a capital of $10,000 by Mary Pech, Dora Pech and Walter Collins. The foundry has been doing a very good business under the management of Miss Dora Pech.

The Chicago Pneumatic Tool Co. has found it necessary to increase the capacity of its air compressor works at Franklin, Pa., from a capacity of 450 compressors per year to a capacity of from 650 to 700 per year, to enable it to keep up with the present demand.

The A. Gilbert Sons Brass Foundry Co., of St. Louis, Mo., has been incorporated with a capital stock of $10,000. The company is a successor to A. Gilbert & Sons, brass founders, its business being the manufacture of car and engine brasses, babbitt metals, solder, etc. Chas. F. Gilbert is president.

The firm of Silver Bros. of Salt Lake City, Utah, has been re-organized. Joseph A. Silver has become president and manager; Jas. W. Silver vice president and assistant manager; L. S. Hills, treasurer, and Joseph G. Fueger, secretary. The company plans to move the plant from its present site on North Temple street to a site on Fourth West street between Sixth and Seventh South streets. The new foundry and shops will be modern in all respects. The Silver Bros. Co. was established in 1864, and hence is one of the oldest plants of the kind in the west.

The Knoxville Metal Bed Co., of Knoxville, Tenn., has its new foundry in operation.

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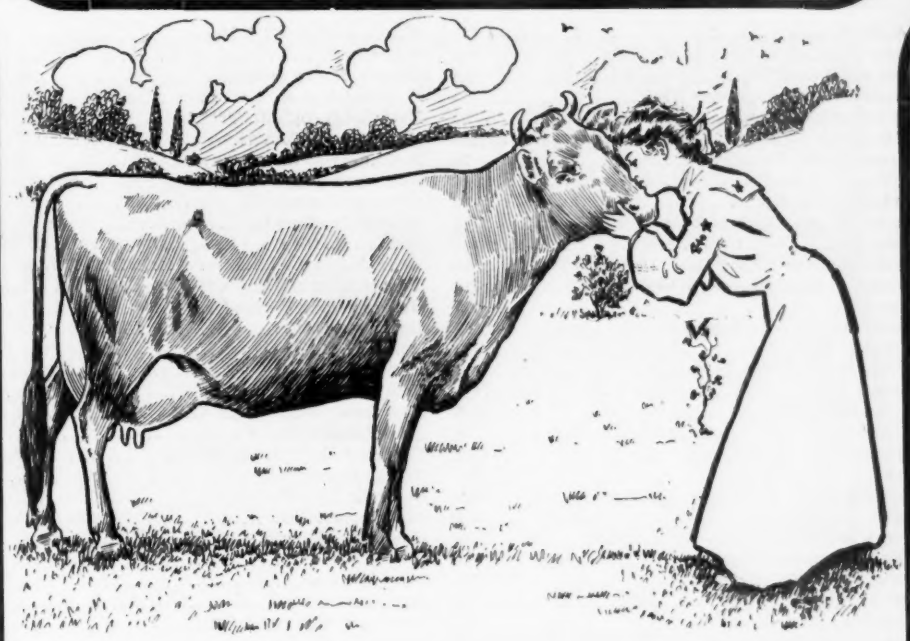

'Everyone to Their Own Taste'

is what the woman said when she kissed the cow.

This Has Nothing to do With Flour

other than emphasize the fact that one grade of Flour will not suit every foundry.

We handle

Second Bakers, Low Grade, Paste, Piq-Cor, Seq-Cor and Red Dog Flours.

THE PIQUA FLOUR CO.

Piqua, Ohio, U.S.A.

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Did you ever stop to think of it?

Every mistake in Foundry Practice costs money, and the discovery is not made until too late to correct the error!

All Foundrymen agree that molding under most favorable conditions holds an element of uncertainty.

The less favorable the conditions the greater the uncertainty.

The better the facings are, the less are the chances for rough unsightly castings.

Another thing — the better the facing, the more the cost of cleaning castings is reduced.

These are some reasons why it pays to use

STEVENS'
GENUINE EAST INDIA PLUMBAGO
or IMPORTED CEYLON LEAD

There are more reasons and good ones; in fact there is no reason why you should use anything else.

A cask may be had any time, subject to approval; then the burden is on me.

I have "Everything for a Foundry."

I manufacture, also, Polishers' and Platers' Supplies.

FREDERIC B. STEVENS

Cor. Third and Larned Sts.
DETROIT.

CLASSIFIED

BUYERS' DIRECTORY

Advertisers' names are inserted under this heading at the rate of four classifications to each page advertisement carried regularly.

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Norton Emery Wheel Co.....Worcester.

Accountants:

Gunn, Richards & Co.....New York.

Air Compressors:

American Air Compressor Co.....New York.
The Norwalk Iron Works Co....So. Norwalk, Conn.
Ingersoll-Rand Co.....New York.
Curtis & Co. Mfg. Co.....St. Louis.

Air Hoists:

Curtis & Co. Mfg. Co.....St. Louis.
Craig Ridgway & Son.....Coatesville, Pa.

Alloys:

Geo. G. Blackwell Sons & Co., Ltd., ... Liverpool Eng.
The New Era Mfg. Co.
The Phosphor Bronze Smelting Co., Ltd., ... Philadelphia.

Analysis, Mechanical:

W. J. Keep .....Detroit.

Analysis, Chemical:

Ricketts & Banks.....New York

Anchors:

W. W. Lindsay & Co.....Philadelphia.

Blowers:

B. F. Sturtevant Co.....Boston.
The Connersville Blower Co.....Connersville, Ind.
American Blower Co.....Detroit.
J. B. & J. M. Cornell Co.....New York
P. H. & F. M. Roots Co.....Connersville, Ind.

Babbitt Metal:

The Ajax Metal Co.....Birmingham, Ala.

Brass Founders' Equipments:

The S. Obermayer Co.....Cincinnati.
Oscar Barnett Fdy. Co. .....Newark.
Fredrick B. Stevens.....Detroit.

Brass Melting Furnaces:

Hawley Down Draft Furnace Co.....Chicago.
Oscar Barnett Fdy. Co. .....Newark.
Rockwell Engineering Co.....New York.
The Monarch Engineering & Mfg. Co...Baltimore.

Brass Molders' Flasks:

The Adams Co..... Dubuque.
The J. D. Smith Foundry Supply Co.....Cleveland.
Oscar Barnett Foundry Co.....Newark, N. J.

Brushes:

The Osborn Mfg. Co.....Cleveland.

Burners, Oil for Core Ovens and annealing:

The Monarch Engineering & Mfg. Co...Baltimore.

Carbonese:

Midvale Mining & Mfg. Co., East St. Louis, Ill.

Cement (Metallic):

The Clark Cast Steel Cement Co....Shelton, Conn.
The Shanafelt Mfg. Co.....Canton, O.
Smooth-On Mfg. Co.....Jersey City.
Shelton Metallic Filler Co.....Derby, Conn.

Chaplets:

W. W. Lindsay & Co.....Philadelphia.
Burdick & Son.....Albany.
The Shanafelt Mfg. Co.....Canton, O.
Fanner Mfg. Co.....Cleveland.
Samuel H. Caufman.....Chester, Pa.
The Hill & Griffith Co.....Cincinnati.
U. S. Chaplet Co.....New York

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The Metallurgical Laboratory.....Pittsburg.

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Ingersoll-Rand Co.....New York.

Clamps (Flask):

Oscar Barnett Foundry Co ....Newark.

Coke:

Rogers, Brown & Co.....Cincinnati.

Core Binders:

C. E. Mills Oil Co.....Syracuse.
Holland Linseed Oil Co.....Chicago.
Buckeye Milling Co.....Cleveland.
The Millers' Products Co.....Chicago.
Robeson Process Co.....Camden, N. J.
The Piqua Flour Co.....Piqua, O.
National Jeloluse Co.....New York.
Sterling Oil Co.....Emlenton, Pa.

Core Machines:

Brown Specialty Mach'y Co.....Chicago.
The Kent Mfg. Co.....Kent, Ohio.
Falls Rivet & Mach Co.....Cuyahoga Falls, Ohio.
Jones & Atwood.....Stourbridge, Eng.
The Turner, Vaughn & Taylor Co., ...Cuyahoga Falls, O.

Core Oven Recording Thermometer:

The Bristol Co.....Waterbury.

Core Ovens:

Atlas Car & Mfg. Co.....Cleveland.
Falls Rivet & Mach Co.....Cuyahoga Falls, Ohio.
Millet Core Oven Co.....Brightwood, Mass.
J. W. Paxson Co.....Philadelphia.
The J. D. Smith Foundry Supply Co.....Cleveland.

Cranes:

Pedrick & Ayer Co.....Plainfield, N. J.
Manning, Maxwell & Moore,.....New York.
Wilcox Mfg. Co.....Aurora, Ill.
Curtis & Co. Mfg. Co.....St. Louis.
Niles-Bement-Pond Co.....New York.
Maris Bros .....Philadelphia.
Pawling & Harnischfeger.....Milwaukee.
Craig Ridgway & Son.....Coatesville, Pa.
Whiting Fdy. & Equip't Co.....Harvey, Ill.
Northern Engrg. Works.....Detroit.
William Sellers & Co., Inc.....Philadelphia.
The Case Mfg. Co.....Columbus, O.

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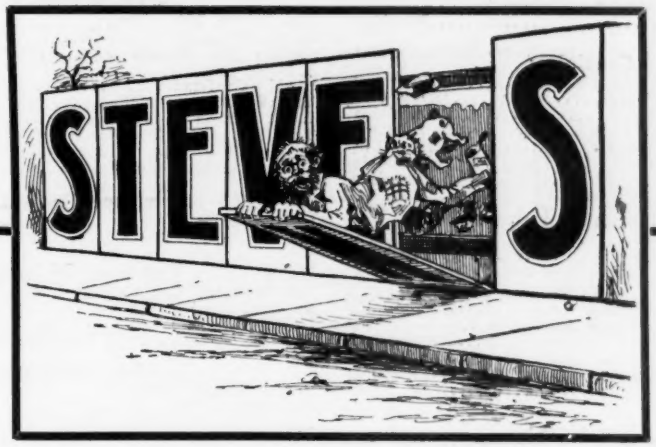

The Missing Letter

All the advertisements in this edition are in a way advertising my warehouse stock of Foundry Supplies. I carry them all—or nearly all—you can have quicker service and at just as low a price by buying them from me.

POLISHERS' AND PLATERS' SUPPLIES

I manufacture an entire line of polishing compositions—Tripoli, Crocus, Rouge, etc. These compositions are, from a practical point of view, the very best now on the market. The term "best" is a relative adjective, of course, and I use it in just that way, meaning that there is nothing so good offered today. If you will send that missing letter I will prove this statement.

BRASS FOUNDERS' SUPPLIES

There are several missing letters in my mail from Brass Founders who are in a hurry for supplies or who are not entirely satisfied with their present stock. Mail the letter and I will do the rest.

FREDERIC B. STEVENS

Corner Third and Larned Streets

DETROIT, MICH.

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O. J. Moussette.....Brooklyn.

Crucibles:
McCullough-Dalzell Crucible Co.....Pittsburg.
J. H. Gautier & Co.....Jersey City.
J. W. Paxson Co.....Philadelphia.
Ross-Taeony Crucible Co.....Philadelphia.
Jos. Dixon Crucible Co.....Jersey City
Robt. J. Taylor, Inc.....Philadelphia.
Fair, Taylor Co. .....San Francisco.

Cupola Linings:
J. W. Paxson Co.....Philadelphia.
J. S. McCormick Co.....Pittsburg.

Cupolas:
Whiting Fdy. Equipment Co.....Harvey, Ill.
Northern Engrg. Works.....Detroit.
J. W. Paxson Co.....Philadelphia.
Byram & Co.....Detroit.
J. S. McCormick Co.....Pittsburg.
J. Gilmour.....New York.

Elevators:
Craig Ridgway & Son.....Coatesville, Pa.
Curtis & Co. Mfg. Co.....St. Louis.

Engines, Steam:
American Blower Co.....Detroit.
B. F. Sturtevant Co.....Boston.

Engines, Gas:
The Turner, Vaughn & Taylor Co.
.....Cuyahoga Falls, O.

Engineers (Foundry, Mech., Elec. etc.):
Geo. K. Hooper.....New York City.
Dodge & Day.....Philadelphia.

Exhaust Fans:
B. F. Sturtevant Co.....Boston.

Facings:
Hill & Griffiths.....Cincinnati.
F. B. Stevens.....Detroit.
J. S. McCormick Co.....Pittsburg.
Jos. Dixon Crucible Co.....Jersey City.
Buckeye Milling Co.....Cleveland.
J. W. Paxson Co.....Philadelphia.
Moore Facing Works.....Providence.
The S. Obermayer Co.....Cincinnati.
The J. D. Smith Foundry Supply Co.....Cleveland.
The Buffalo Foundry Supply Co.....Buffalo.

Fans:
American Blower Co.....Detroit.
B. F. Sturtevant Co.....Boston.

Ferro-Manganese:
Rogers, Brown & Co.....Cincinnati.
Kendall & Flick.....Washington, D. C.

Ferro-Silicon:
Rogers, Brown & Co.....Cincinnati.
The Raessler & Hasslacher Chemical Co.,
.....New York.

Fire Brick:
J. H. Gautier & Co.....Jersey City.
Henry Maurer & Son.....New York.

Fire Sand:
The Carborundum Co.....Niagara Falls, N. Y.

Flasks:
Brass Founders' Supply Co.....Newark.
Oscar Barnett Fdy. Co.....Newark.
The Adams Co.....Dubuque, Ia.

Flour:
The Buckeye Milling Co.....Cleveland.
The Millers' Products Co.....Chicago.
The Piqua Flour Co.....Piqua, O.

Foundry Supplies:
The Osborn Mfg. Co.....Cleveland.
Cutter, Wood & Stevens Co.....Boston.
Buffalo Fdy. Supply Co.....Buffalo.
F. B Stevens.....Detroit
S. H. Caufman.....Chester, Pa.
The S. Obermayer Co.....Cincinnati.
J. W. Paxson Co.....Philadelphia.
The J. D. Smith Foundry Supply Co.....Cleveland.
Hill & Griffiths.....Cincinnati.
J. S. McCormick Co.....Pittsburg.

Furnace Cement:
J. H. Gautier & Co.....Jersey City.
Jas. Dixon Crucible Co.....Jersey City.

Furnaces, Melting:
The Monarch Engineering & Mfg. Co...Baltimore.
Rockwell Engineering Co.....New York.
J. W. Paxson Co.....Philadelphia.
The Hawley Down Draft Furnace Co.....Chicago.

Grinding Machinery:
Norton Emery Wheel Co.....Worcester.
The Adams Co..... Dubuque.
The Bridgeport Safety Emery Wheel Co.,
.....Bridgeport, Conn.

Grinding Wheels:
Superior Corundum Wheel Co....Waltham, Mass.
Norton Emery Wheel Co.....Worcester.
The Vitrified Wheel Co.....Westfield, Mass.

Grinding Pans:
The Crossley Mfg. Co.....Trenton, N. J.

Heating & Ventilating Apparatus:
American Blower Co.....Detroit.
B. F. Sturtevant Co..... Boston.

Hoists:
Niles-Bement-Pond Co.....New York.
Whiting Fdy. Equipment Co.....Harvey, Ill.
Northern Engrg. Works..... Detroit.
Yale & Towne Mfg. Co.....New York.
Pawling & Harnischfeger.....Milwaukee.
Curtis & Co. Mfg. Co..... ..... St Louis.
William Sellers & Co., Inc.....Philadelphia.

Industrial Ry. Equipment:
B. F. Sturtevant Co..... Boston.
The Atlas Car & Mfg. Co.....Cleveland.

Iron Ore:
Rogers, Brown & Co.....Cincinnati.

Ladle Cars:
C. W. Hunt Co.....W. New Brighton N. Y.

Ladles:
Northern Engrg. Works.....Detroit.

Linseed Oil:
Holland Linseed Oil Co.....Chicago.

Magnetic Separators:
Elm City Engineering Co.....New Haven.
Dings Electro Magnetic Sep. Co.....Milwaukee.
Chas. T. Burlin.....Whitinsville, Mass.

Metal Patterns:
Chas. Herman & Son.....Sharpsburg, Pa.

Metallic Fillers:
The Sheldon Metallic Filler Co.....Derby, Conn.
The Clark Cast Steel Cement Co.....Shelton, Conn.
Smooth-On Mfg. Co.....Jersey City.

Molding Machines:
The Adams Co.....Dubuque.
J. W. Paxson Co.....Philadelphia.
Henry E. Pridmore.....Chicago.
The Tabor Mfg. Co.....Philadelphia.
Turner Machine Co.....Philadelphia.
Manning, Maxwell & Moore,.....New York.
Oregon Fdy. & Mach Co.....Oregon, Ill.
E. H. Mumford Co.....Philadelphia.
Chas. Herman & Son.....Sharpsburg, Pa.
The Berkshire Molding Machine Co.....Cleveland.

CONTINUED ON PAGE 114.

The Cost of It

The expense of a modern system of cost-keeping need be no greater than a crude, antiquated and inefficient way of keeping accounts.

Such a system is accurate, quick and in ample detail, and it gives the detailed costs of every part of the work while the business is fresh—when it is most valuable as a basis of comparison.

We have studied cost-keeping very carefully and have installed systems which meet these requirements in many well-known foundries.

Will you accord us an interview?

GUNN, RICHARDS & COMPANY

Production Engineers and Public Accountants.....

43 WALL STREET, 43 EXCHANGE PLACE, NEW YORK

50 CONGRESS STREET, BOSTON

224 ST. JAMES STREET, MONTREAL

Molding Sand:
Buffalo Fdy. Supply Co.....Buffalo.
J. W. Paxson Co.....Philadelphia.
Cutter, Wood & Stevens Co.....Boston.
F. B. Stevens.....Detroit

Molders' Tools:
William Dobson.....Canastota, N. Y.
The J. D. Smith Foundry Supply Co.....Cleveland.
The S. Obermayer Co.....Cincinnati.

Parting Materials:
The Partamol Co.....New York.

Patterns:
The Gobeille Pattern Co.....Cleveland.

Pattern Shop Equipment:
Fox Machine Co.....Grand Rapids, Mich.

Phosphorizers:
McCullough-Dalzell Crucible Co.....Pittsburg.

Phosphor Tin:
New Era Mfg. Co.....Kalamazoo.

Pig Iron:
Rogers, Brown & Co.....Cincinnati.
J. J. Mohr.....Philadelphia.
N. S. Bartlett & Co.....Boston.
F. A. Goodrich & Co.....Detroit.
Robert Field Sales Agency.....Cincinnati
J. K. Dimmick & Co.....Buffalo.
Dalton, Nash & Co.....New York.
McKeefrey & Co.....Leetonia, Ohio.
Dornhoff & Joyce Co.....Cincinnati.
Columbus Iron & Steel Co.....Columbus.
De Camp Bros. & Yule.....St. Louis.
Pilling & Crane.....Philadelphia.
Cherry Valley Iron Co.....Pittsburg.
The Republic Iron & Steel Co.,
.....Chicago and Birmingham.
Mathew, Addy & Co.....Cincinnati.
J. H. Hillman & Son.....Pittsburg.
Pickands, Brown & Co.....Chicago.
Pickands, Mather & Co.....Cleveland.
The Thomas Furnace Co.....Milwaukee.
Walter Wallingford & Co., Cincinnati and Pittsburg.
F. B. Stevens.....Detroit.
Chas. G. Shepard.....Buffalo.

Plumbago:
Hill & Griffiths Co.....Cincinnati.
F. B. Stevens.....Detroit.
J. H. Gautier & Co.....Jersey City.
Jos. Dixon Crucible Co.....Jersey City.
The S. Obermayer Co.....Cincinnati.
The Buckeye Milling Co.....Cleveland.
McCullough-Dalzell Crucible Co.....Pittsburg.
Pettinos Bros.....Bethlehem, Pa.

Plumbago Stopper Heads:
Ross-Tacony Crucible Co.....Philadelphia.

Pneumatic Tools:
Ingersoll-Rand Co.....New York.
Chicago Pneumatic Tool Co.....Chicago.
Dayton Pneumatic Tool Co.....Dayton.

Polishers' and Platers' Supplies:
Frederic B. Stevens.....Detroit

Positive Pressure Blower:
The Connersville Blower Co.....Connersville, Ind.
P. H. & F. M. Roots Co.....Connersville, Ind.

Riddles:
The Adams Co.....Dubuque.
U. S. Chaplet Co.....New York.

Rubber Sheet Packing:
Smooth-On Mfg. Co.....Jersey City.

Sand Blast Machinery:
Tilghman-Brooksbank Sand Blast Co..Philadelphia.
C. Drucklieb.....New York.

Sand Mixing Machines:
William Sellers & Co., Inc.....Philadelphia.
The Standard Sand & Machinery Co.....Cleveland.

Sand Sifters:
Hanna Engrg. Works.....Chicago.
Deane Steam Pump. Co. .....Holyoke, Mass.
Gould & Eberhardt.....Newark.
Chas. Herman & Son.....Sharpsburg, Pa.
The Standard Sand & Machine Co.....Cleveland.

Saws (Cold Cutting):
The Tabor Mfg. Co.....Philadelphia.

Seacoal:
Buffalo Foundry Supply Co.....Buffalo.
The S. Obermayer Co.....Cincinnati.
J. W. Paxson Co.....Philadelphia.
The Hill & Griffith Co.....Cincinnati.

Shafting (Flexible):
Coates Clipper Mfg. Co.....Worcester, Mass.
Stow Mfg. Co.....Binghamton, N. Y.

Shovels:
F. B. Stevens.....Detroit.
H. Channon Co.....Detroit.
Cutter, Wood & Stevens Co.....Boston.

Silica Wash:
Buffalo Fdy. Supply Co.....Buffalo.

Snap Flasks:
The S. Obermayer Co.....Cincinnati.
Diamond Clamp & Flask Co.....Richmond, Ind.
The Adams Co.....Dubuque.
Smith & Gaffrey Co.....Syracuse, N. Y.

Soapstone Facing:
F. B. Stevens.....Detroit.

Soil Pipe Equipment:
Oregon Fdy. & Mach. Co.....Oregon, Ill.

Sprue Cutters:
The F. B. Shuster Co.....New Haven.
Oscar Barnett Fdy. Co. .....Newark.
Waterbury Farrell Fdy.....Waterbury, Conn.

Steel Barrels:
Kilbourne & Jacobs Mfg. Co.....Columbus.

Steel Castings:
The Otis Steel Co., Ltd.....Cleveland.

Stoppers:
McCullough-Dalzell Crucible Co.....Pittsburg.

Stove Trimmings:
The Fanner Mfg. Co.....Cleveland.
Burdick & Son.....Albany, N. Y.

Testing Machines:
W. J. Keep .....Detroit.

Thermit Process:
Goldschmidt Thermit Co.....New York.

Trolley Track:
New Jersey Foundry & Machine Co.....New York.
R. T. Randall & Co.....New York and Philadelphia.

Tumbling Mills:
The Adams Co.....Dubuque.
Falls Rivet & Mach Co.....Cuyahoga Falls, Ohio.
Waterbury Farrel Fdy.....Waterbury, Conn.
J. Gilmour.....New York.

White Metal Melting Furnaces:
Rockwell Engrg. Co.....New York.

Wire Straighteners:
The F. B. Shuster Co.....New Haven.
Geo. F. Blake Mfg. Co.....New York City.

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Undisplayed advertisements will be inserted under this head at 40 cents per line each insertion.

FOR SALE.—Foundry Cranes—One 25-ton electric steel jib crane, adjustable to hand power if needed, 25 feet radius, used only two years, good as new; also two 10-ton wooden jib cranes, 25 feet radius, lift 14 feet in all three cranes, geared fast and slow speeds—will sell cheap. Address, Box 572, THE FOUNDRY, Cleveland, Ohio.

BLOWER BARGAINS.
Roots Second-Hand Blowers, bought, sold or exchanged for new ones. Address,
H. M. PAPWORTH,
120-122 Liberty Street, New York City.

FOR SALE.—Foundry and machine shop in good Iowa town doing a general jobbing and contract work. Address, Box 567, THE FOUNDRY, Cleveland, Ohio.

FOR SALE.—No. 4 Green Pressure Blower in use about two years, good as new. Address, SALEM BRASS & IRON MFG. CO., Salem, N. J.

FOR SALE:—Well equipped foundry and machine shops in mining district of 30,000 inhabitants. Owner wishes to retire. Address Box 545, THE FOUNDRY, Cleveland.

FOR SALE.—Two Tumbling Mills in good condition. For full particulars address, Keith Furnace Company, Des Moines, Ia.

Facings of all kinds. Prices everlastingly lowest, qualities everlastingly best. BERG MINING CO., N. Y.

German Black Lead. Prices everlastingly lowest, quality everlastingly best. BERG MINING CO., N. Y.

Ceylon Plumbagos. Prices everlastingly lowest, quality everlastingly best. BERG MINING CO., N. Y.

East India Silver Lead. Prices everlastingly lowest, grade everlastingly best. BERG MINING CO., N. Y.

Prices everlastingly lowest, goods everlastingly best. Plumbagos and Leads. BERG MINING CO., N. Y.

FLUOR SPAR.—Lump and Gravel. Special Qualities. Delivered Eastern Ports. Enquiries solicited. DRABBLE BROS., Mineral Merchants, Matlock, England.

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or agents Penna. Salt Mfg. Co., Pittsburg, Pa.

MISCELLANEOUS.

Undisplayed advertisements will be inserted under this head at 25 cents per line each insertion.

WANTED.—2½ to 5-ton cupola and other foundry equipment for an iron and brass jobbing foundry. Address, Box 569, THE FOUNDRY, Cleveland, Ohio.

A steady income can be had by investing $1.00 or more each month for ten months. For particulars send name and address to P. O. Box, 504 Loganport, Ind.

WANTED.—One second hand Hill crusher, small size, for use on ashes in brass foundry. Address, Box 573, THE FOUNDRY, Cleveland, Ohio.

WANTED.—A good 2nd. hand Cupola of about 8 to 10 ton capacity per hour; a 5 to 10 ton Traveling Hand Power Crane, about 29 feet span, and a Root or Connellsville Blower. Address Box 585, THE FOUNDRY, Cleveland, Ohio.

A POUND of Fluor Spar Crystals thrown on to a badly acting heat will save a lot of trouble and possibly profanity on the part of the melter as well as increasing the tensile strength of the casting by volatilizing the sulphur. A barrel of these crystals—pure, crystallized fluor spar—weighing between 500 and 550 pounds will be delivered freight paid at any railroad station east of the Mississippi river upon receipt of $12.00. We have supplied many of the larger southern pipe foundries for a number of years with this splendid product in can lots decreasing their pipe breakage from a large percentage of the castings to practically nothing. It will certainly pay any foundryman to have a barrel of crystals on the charging floor open and ready for use. We guarantee 99½ per cent efficiency. Address ROBERTS & COMPANY, Rome, Tennessee.

HELP WANTED.

Undisplayed advertisements will be inserted under this head at 25 cents per line each insertion.

WANTED.—First class foundry foreman with executive ability to take charge of foundry employing two hundred hands. Medium and light, floor, bench and machine molding. Good salary to competent man. Address with reference, Box 541, THE FOUNDRY, Cleveland, Ohio.

WANTED.—Foundry foreman to take charge of shop employing 75 bench and floor molders, making a good class of gray iron castings running in weight from 1 ounce to 3 tons, 90 per cent of work done by piece. Must be practical and of good character and have the ability to handle men to get the best results. Knowledge of cupola practice not necessary. State age, experience, references and salary expected. First class opportunity for the right party. Address, Box 568, THE FOUNDRY, Cleveland, Ohio.

WANTED.—A first class experienced superintendent, familiar with the steel range business, competent to handle a large force of men. Good salary and permanent employment for the right man. No one considered who has not already a successful experience in this line. Address, Box 571, THE FOUNDRY, Cleveland, Ohio.

WANTED.—A capable foreman to run a small foundry connected with a large industrial works. Modern equipment. Average weekly output 10,000 pounds iron, 1,000 pounds brass castings. Will arrange payment either on salary or tonnage basis. Permanent position. Address, Box 570, THE FOUNDRY, Cleveland, Ohio.

WANTED.—A man for general foreman for a malleable foundry. Must have had experience, especially with annealing, and charging of furnaces in some modern malleable foundry. A young man preferred. Address, Box 575, THE FOUNDRY, Cleveland, Ohio.

CONTINUED ON PAGE 118.